# Attached Payload Hardware Interface Control Document Template

# International Space Station Program

## August 5, 2002

## Revision A

## TYPE 1 – APPROVED BY NASA

**THE INFORMATION CONTAINED IN THE "ATTACHED PAYLOAD HARDWARE INTERFACE CONTROL DOCUMENT TEMPLATE" IS "INTERFACE" DATA, WHICH IS CONTROLLED BY THE EXPORT ADMINISTRATION REGULATIONS (EAR) (15 CFR part 730 et. seq), AND CLASSIFIED AS EAR99 UNDER THE EAR. RE–EXPORT OR RE–TRANSMISSION OF SUCH DATA IN VIOLATION OF THE EAR OR OTHER EXPORT CONTROL LAWS AND REGULATIONS IS PROHIBITED.**

**National Aeronautics and Space Administration**
**International Space Station Program**
**Johnson Space Center**
**Houston, Texas**
**Contract No. NAS15–10000 (PA10)**

## REVISION AND HISTORY PAGE

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ERU: /s/ M. HEHN 08–30–02

# INTERNATIONAL SPACE STATION

# ATTACHED PAYLOAD
# HARDWARE INTERFACE CONTROL DOCUMENT TEMPLATE

## PREFACE

This Hardware Interface Control Document (ICD) Template is the exclusive document to be used jointly by the National Aeronautics and Space Administration (NASA) and the Attached Payload developer to identify, establish and control Attached Payload physical/functional interfaces. The Attached Payload ICD serves to define and control Attached Payload interfaces to ensure compatibility with the International Space Station (ISS). This document is to be used as a template for the development of Attached Payload Unique ICDs and to document the Attached Payload developer's design implementation of the interface requirements. These include the mechanical, structural, electrical, avionics, and functional interfaces, as specified in the Attached Payload Interface Requirements Document (IRD), SSP 57003. The applicability of specific interfaces defined herein will depend upon the characteristics of each integrated Attached Payload. The Attached Payload ICD Template contains an introduction, a list of applicable documents, subsections on general and detailed interfaces, a traceability matrix, list of exceptions, deviations, and waivers, and appendices containing acronyms, definitions, and exceptions. The interfaces defined in this document are mandatory and may not be violated unless specifically agreed upon in writing by the Space Station Payload Control Board (PCB) and the Attached Payload developer. This document is under the control of the PCB, and any changes or revisions will be approved by the Payload Office Manager and the Attached Payload Representative. Signatures of the Attached Payload Representative will be added to the preface of each Unique Payload Interface Control Document. **(TBR #1)**

Approved By: /s/ Daniel W. Hartman 8/9/02

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# INTERNATIONAL SPACE STATION

## ATTACHED PAYLOAD
## HARDWARE INTERFACE CONTROL DOCUMENT TEMPLATE

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## INTERNATIONAL SPACE STATION

## ATTACHED PAYLOAD
## HARDWARE INTERFACE CONTROL DOCUMENT TEMPLATE

## LIST OF CHANGES

All changes to paragraphs, tables, and figures in this document are shown below:

| SSCD | ENTRY DATE | CHANGE | PARAGRAPH(S) |
|---|---|---|---|
| 004089 | 02/28/01 | 57004–NA–0001A | 3.2, 3.2.3, 3.2.4.1, 3.2.5 |
| | | | **TABLE(S)** |
| | | | 3.2.3–1, 3.2.5–1 |
| | | | **FIGURE(S)** |
| | | | 3.2.4.1–3, 3.2.4.1–4, 3.2.5–1 |
| | | | **PARAGRAPH(S)** |
| | | 57004–NA–0002A | 3.1.2.8 |
| | | | **FIGURE(S)** |
| | | | 3.1.2.8–2, 3.2.1–2 (added) |
| | | | **PARAGRAPH(S)** |
| 006967 | 08/09/02 | 57004–NA–0003C | 1.4.1, 1.4.2, 3.1.2.2, 3.1.2.3, 3.1.3.2, 3.2, 3.2.2, 3.2.6, 3.4.2, 3.7, 3.7.1, 3.7.2 |
| | | | **TABLE(S)** |
| | | | 1.4–1, 1.4–2, 3.1.4.1–1, 3.2.1–1, 3.2.6–1, 3.7.2–1, D–1, D–2 |
| | | | **FIGURE(S)** |
| | | | 3.1.2–1, 3.1.2–2, 3.1.2.1–1, 3.1.2.1–2, 3.1.2.2–1, 3.1.2.2–2, 3.1.2.3–1, 3.1.3.2–1, 3.7.1–1, 3.7.2–1, 3.7.2–2 |

# TABLE OF CONTENTS

**TABLE OF CONTENTS (Continued)**

## TABLE OF CONTENTS (Continued)



## APPENDIX

# TABLES

## FIGURES

## FIGURES (Continued)

# 1.0 INTRODUCTION

As a research platform in near–earth orbit, the International Space Station (ISS) provides installation and operational support of science and technology experiments and their associated support equipment at four external attach sites on the Integrated Truss Assembly (ITA) S3 and two external attach sites on the ITA P3. ”Attached Payload” is the generic term used to identify those scientific and technology experiments packaged for launch, ISS integration and operation in the unpressurized near earth orbit environment. For the purposes of this document, an Attached Payload shall be defined as an experiment or collection of experiments and associated support equipment pre–integrated on a carrier that interfaces directly to a Payload Attach System (PAS) or an Unpressurized Cargo Carrier Attach System (UCCAS) location on Integrated Truss Segment (ITS) S3 or ITS P3.

The NASA sponsored Expedite the Processing of Experiments to Space Station (EXPRESS) program provides a structural platform for external payloads to be mounted on the U.S. truss segment. Resources and Accommodations available to EXPRESS Pallet payloads may be found in SSP 52000–PAH–EPP, International Space Station Payload Accommodations Handbook Expedite the Processing of Experiments to Space Station (EXPRESS) Pallet Payloads.

## 1.1 PURPOSE

This Interface Control Document (ICD) template is the primary source of design implementation and control of Attached Payload specific interfaces in accordance with the Attached Payloads Interface Requirements Document, SSP 57003. The purpose of this document is to assist Attached Payload developers in the development of unique Attached Payload ICDs. The unique ICD controls the ISS and Attached Payload interfaces for integration into the ISS. The physical, functional and environmental design implementation associated with Attached Payload safety and interface compatibility is included herein. The Attached Payload unique ICDs derived from this document control the hardware interfaces between the Attached Payload and the following Space Shuttle or Space Station systems:

- Shuttle Remote Manipulator System (SRMS)
- Mobile Servicing System (MSS)
  - Space Station Remote Manipulator System (SSRMS)
  - Special Purpose Dexterous Manipulator (SPDM) System
- ITS S3 PAS and P3 UCCAS

## 1.2 SCOPE

This Attached Payload ICD Template only addresses the interface of the Attached Payloads to be located on ITS S3 PAS and P3 UCCAS sites. The interfaces defined in this document apply to on–orbit phases of the Attached Payload mission cycle. The reader is referred to NSTS 21000–IDD–ISS, Shuttle Orbiter Interface Definition Document for International Space Station to determine interface requirements for the payload when located in the Space Shuttle.

## 1.3 USE

This document is to be used as the template for developing Attached Payload unique ICDs. Section 1.0, Introduction, of this document includes the introduction. Section 2.0, Documentation, lists the applicable documents associated with this ICD. Section 3.0, Attached Payload Interfaces, contains interface design implementation and ISS specific interface information. Section 4.0, Applicability Matrix, provides traceability to the interface requirements and corresponding verification requirements contained in SSP 57003, Attached Payload Interface Requirements Document. Section 5.0, Exceptions, Deviations, and Waivers, defines any exceptions to requirements, capabilities, or services defined in SSP 57003, and contains a table showing the specific requirements violated or excepted, a description of the existing condition, and a rationale for acceptance. Additional documentation and presentations to control boards containing cost, schedule, and technical impacts may be required for approval of deviations and waivers.

NOTE: During the development of each Attached Payload unique ICD, the Attached Payload developer may take exception to any interface requirement by following the procedures outlined in Section 5.0. The Attached Payload developer will be responsible for analyses and documentation necessary to justify acceptance of the exception and for forwarding the exception to the appropriate NASA board for approval. Attached Payload unique ICDs will not alter the interfaces identified in this document; they can only identify which interfaces and requirements apply, do not apply, or are taken exception to by the Attached Payload developer. When the Attached Payload developer establishes that a requirement is applicable, the corresponding verification requirement is defined in Section 4.0 of SSP 57003 is also applicable and accepted by the Attached Payload developer. Figure 1.3–1 shows the relationship between the IRD, the ICD Template, and the Attached Payload unique ICD.

Attached Payload developers are responsible for providing:

A. Introduction and Attached Payload description.

B. Agreement on applicable documents in Section 2.0.

C. Specific interface design implementation information in Section 3.0.

D. Applicability matrix of IRD requirements in Section 4.0.

E. All exceptions to requirements defined in SSP 57003 in Section 5.0.

The information provided in Sections 3.0 and 4.0 are the fundamental elements for every Attached Payload unique ICD. Section 5.0 will contain all Attached Payload unique exceptions.

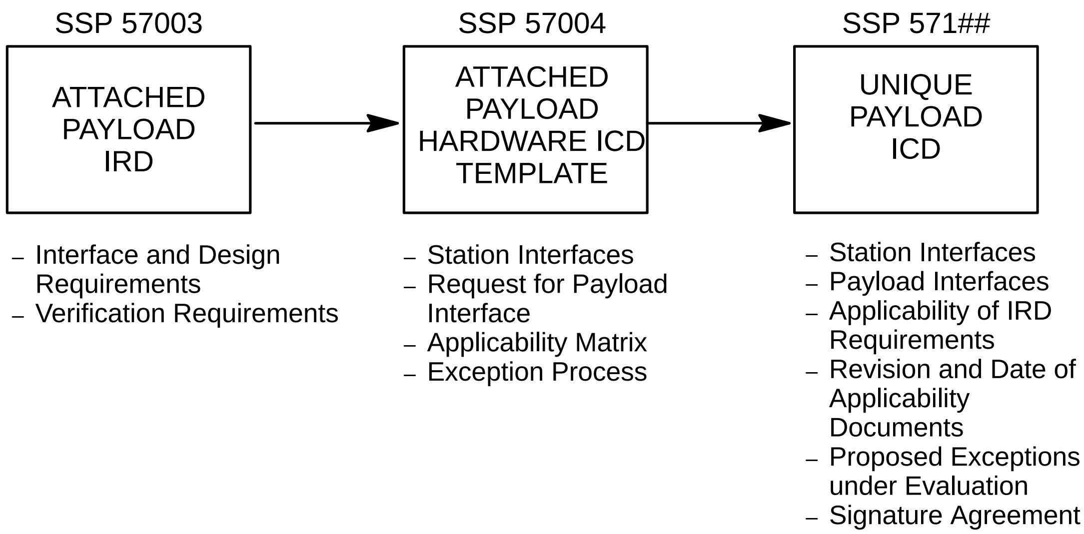



**FIGURE 1.3–1 PAYLOAD INTERFACE REQUIREMENTS AND CONTROL PROCESS**

## 1.4 GENERAL INFORMATION

> Note: The Attached Payload developer will provide a top–level functional description and isometric view of the integrated Attached Payload. The description includes, but is not limited to purpose, physical and functional description, modes of operation, and unique Attached Payload characteristics.

### 1.4.1 GENERAL NOTES

The following notes apply to all figures and drawings:

A. All critical tolerances and dimensions shown are in accordance with ANSI Y14.5, Dimensioning and Tolerancing.

B. All dimensions are in inches unless otherwise specified.

C. All bonding surface locations and preparations are defined (when necessary).

D. Physical and mechanical interface definitions are in accordance with DOD–STD–100, Military Standard, Engineering Drawing Practices.

E. Mounting, installation and attachment provisions include:

   (1) Fastener part numbers (when necessary)

   (2) Fastener location (when necessary)

F. Payload data are to be submitted in the following formats:

   (1) Graphics are submitted electronically using Uni–Graphics (.dgn, .dxf, .iges), Intergraph EMS (.dgn, .dxf, .iges), Microstation (.dgn) or Canvas compatible word processing or spreadsheet software.

   (2) Text is submitted in English using Microsoft Word for Windows or a compatible word processing or spreadsheet software.

### 1.4.2 ENGINEERING UNITS AND TOLERANCES

Unless otherwise noted herein, all dimensions in this document are shown in the English system of inch pound (in–lb) units. Implied tolerances on linear dimensions are defined in Table 1.4.2–1. Angular Tolerances are shown in Table 1.4.2–2. Dimensions enclosed within parenthesis are shown for reference only and provide no tolerance. Orthographic projections are constructed using the third angle projection system.

**TABLE 1.4.2–1 LINEAR TOLERANCES**

| Dimensions | Tolerances |
|---|---|
| .xx | +/– 0.3 inches |
| .xxx | +/– .010 inches |

**TABLE 1.4.2–2 ANGULAR TOLERANCES**

| Dimensions | Tolerances |
|---|---|
| x degrees | +/– 1 degree |
| x degrees x minutes | +/– 0 degrees 30 minutes |

## 2.0 DOCUMENTATION

The following documents include specifications, models, standards, guidelines, handbooks, and other special publications. Specific date and revision number of documents under control of the Space Station Control Board can be found in SSP 50257, Program Control Document Index, or SSP 50258, Prime Control Document Index. The documents in this section are inclusive to those specified herein. They form a part of this ICD to the extent specified herein. In the event of a conflict between the documents referenced and the contents of this ICD the contents of this ICD shall be considered a superseding requirement.

## 2.1 APPLICABLE DOCUMENTS

| DOCUMENT NO. | TITLE |
|---|---|
| 98H0749 | ISS S3 Segment Thermal Math Model Report |
| ANSI Y14.5 | Dimensioning and Tolerancing |
| D684–10058–03–01 | ISS Thermal Math Model, Volume 3, Book 1 |
| DOD–STD–100 | Military Standard, Engineering Drawing Practices |
| MIL–STD–1553 | Digital Time Division Command/Response Multiplex Data Bus |
| NSTS 21000–IDD–ISS | Shuttle Orbiter Interface Definition Document for International Space Station |
| SSP 30219 | Space Station Reference Coordinate Systems |
| SSP 30245 | Electrical Bonding Requirements |
| SSP 30256 | Extravehicular Activity Standard |
| SSP 30550 | Space Station Program Robotic Systems Integration Standards, Volume 1 |
| SSP 42004 | Mobile Servicing System to User (generic) Interface Control Document Part 2 |
| SSP 42131 | Space Station Program Integrated Truss Segment P3 and S3 To Attached Payloads and Unpressurized Cargo Carriers (UCC) Standard Interface Control Document |
| SSP 50005 | ISSA Flight Crew Integration Standard |
| SSP 50184 | High Rate Data Link Physical Media, Physical Signaling & Protocol Specifications |
| SSP 50257 | Program Control Document Index |
| SSP 50258 | Prime Control Document Index |
| SSP 52000–PAH–EPP | International Space Station Payload Accommodations Handbook Expedite the Processing of Experiments to Space Station (EXPRESS) Pallet Payloads |
| SSP 57003 | International Space Station Program Attached Payload Interface Requirements Document |
| SSP 57013 | Generic Attached Payload Verification Plan |

| DOCUMENT NO. | TITLE |
|---|---|
| SSQ 21637 | Connectors and Accessories, Electrical, Umbilical Interface, Environmental Space Quality, General Specification |
| SSQ 21654 | Cable, Single Fiber, Multitude, Space Quality, General Specification Document |
| SSQ 21655 | Cable, Electrical, MIL–STD–1553 Data Bus, Space Quality, General Specification |

## 2.2 REFERENCE DOCUMENTS

| | |
|---|---|
| SP–M–229 | Addendum Specification to Prime Item Development Specification for Integrated Truss Element P3 for Integrated Truss Segment (ITS) S3 |
| SP–M–235 | Specification to Prime Item Development Specification for Integrated Truss Element P3 |
| SP–M–600 | Configuration Item Specification for the Capture Latch Assembly |
| SP–M–601 | Configuration Item Specification for the Umbilical Mechanism Assembly |
| SP–M–602 | Configuration Item Specification for the Payload Attach System |
| SP–M–603 | Configuration Item Specification for the Unpressurized Cargo Carrier Attach System |
| SSP 30263–002 | Remote Power Controller Module (RPCM) ICD |

## 2.3 UNIQUE ICD APPLICABLE DOCUMENTS

Attached Payload developers will be developing their payloads to the current version of SSP 57003 and the applicable documents contained therein. This applies to those applicable documents that correspond to requirements marked as applicable in section 4.0, Applicability Matrix, of their unique ICD. This matrix provides the traceability to the applicable IRD requirement and hence the corresponding verification requirement. Each Attached Payload developer will be responsible for impacting any changes processed to these applicable documents and report to the ISS Payload Program Office as to whether the changes impact them. Changes that impact the Attached Payload development will be processed with either a waiver or design change that is approved by the ISS Program Office.

> Note: The Attached Payload developer must provide a listing of Attached Payload unique ICD applicable documents with revision letter and date in this section.

# 3.0 ATTACHED PAYLOAD INTERFACES

## 3.1 STRUCTURAL/MECHANICAL INTERFACES

### 3.1.1 INTERFACE WITH THE MOBILE SERVICING SYSTEM

The Attached Payload to MSS interface provides structural support for the Attached Payload while attached to the Mobile Remote Servicer (MRS) Base System (MBS) Common Attach System (MCAS). The MCAS also provides access to power and data resources from the ISS via an Umbilical Mechanism Assembly (UMA) while the MSS is parked and utilizing a truss utility port. The mechanical interface between the Attached Payload and the MCAS is physically similar to the interface with the PAS sites. An SSRMS compatible grapple fixture on the Attached Payload provides an additional structural/mechanical interface with the MSS allowing the SSRMS or Payload/Orbital Replacement Unit (ORU) Accommodation (POA) to grapple the payload. When a Power Data Grapple Fixture (PDGF) is used, power, data and video interfaces may also be available through the Grapple Fixture.

> Note: The Attached Payload developer must provide drawings and/or documentation that fully describe the Attached Payload’s structural, mechanical and electrical interface with the MSS and also demonstrate compliance with SSP 42004, Mobile Servicing System to User (generic) Interface Control Document, Part 2.

### 3.1.2 INTERFACE WITH THE ISS TRUSS

The physical interface between the ISS and Attached Payloads occurs at a PAS or UCCAS site. The four PAS sites located on the ITS S3 have been designated as primary Attached Payload sites. The two UCCAS sites located on the ITS P3 will serve as auxiliary Attached Payload sites to be used on an as available basis. The ITS design is controlled by SP–M–235, Specification to Prime Item Development Specification for Integrated Truss Element P3, and SP–M–229, Addendum Specification to Prime Item Development Specification for Integrated Truss Element P3 for Integrated Truss Segment ITS S3. All six interfaces support the transfer of structural loads, power and data. All six sites are configured for support of multiple cycles of robotically assisted Attached Payload and Unpressurized Logistics Carrier (ULC) installation and removal. All six sites are also configured for remotely actuated connection and disconnection of Attached Payloads and ULCs to and from the ISS resources and services. PAS sites are shown in Figure 3.1.2–1. UCCAS sites are shown in Figure 3.1.2–2.

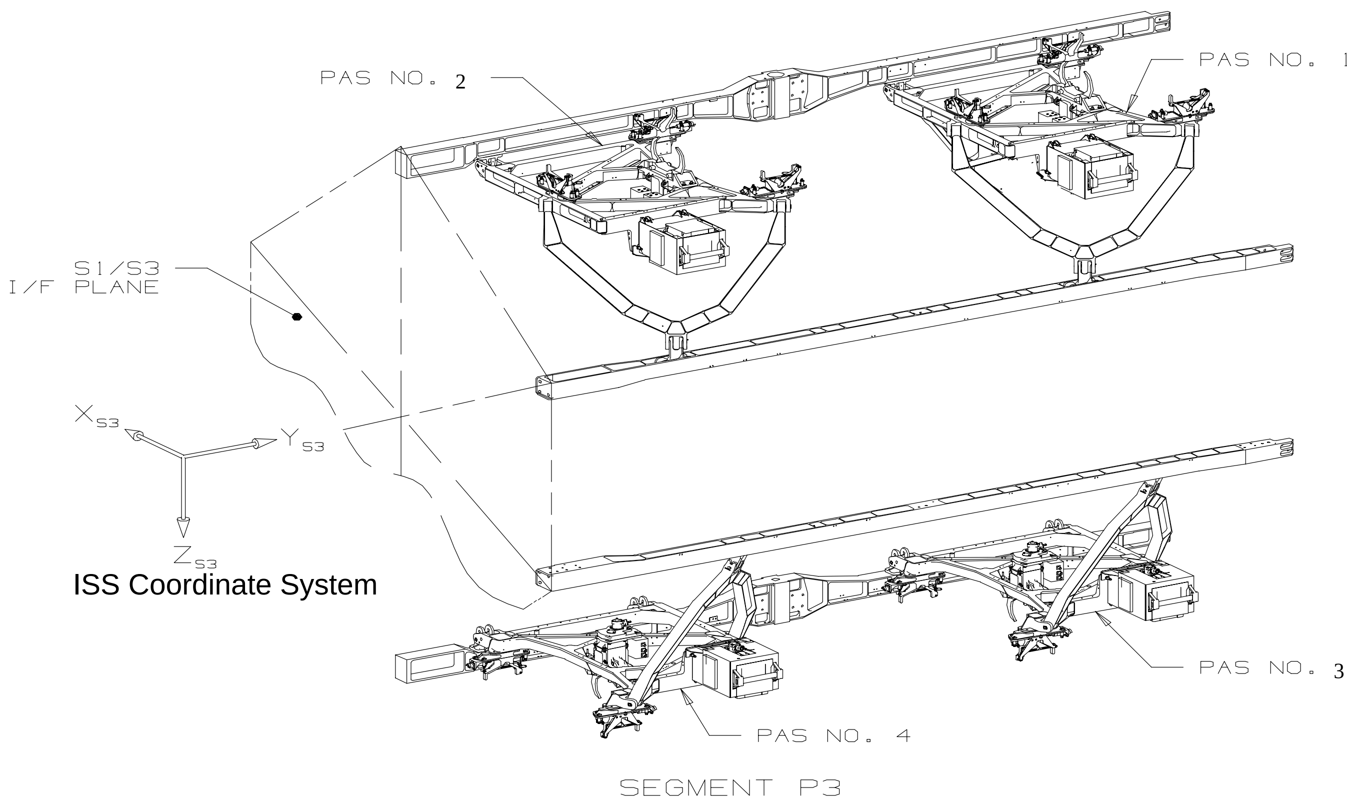



**FIGURE 3.1.2–1 ITS S3 PAS SITES**

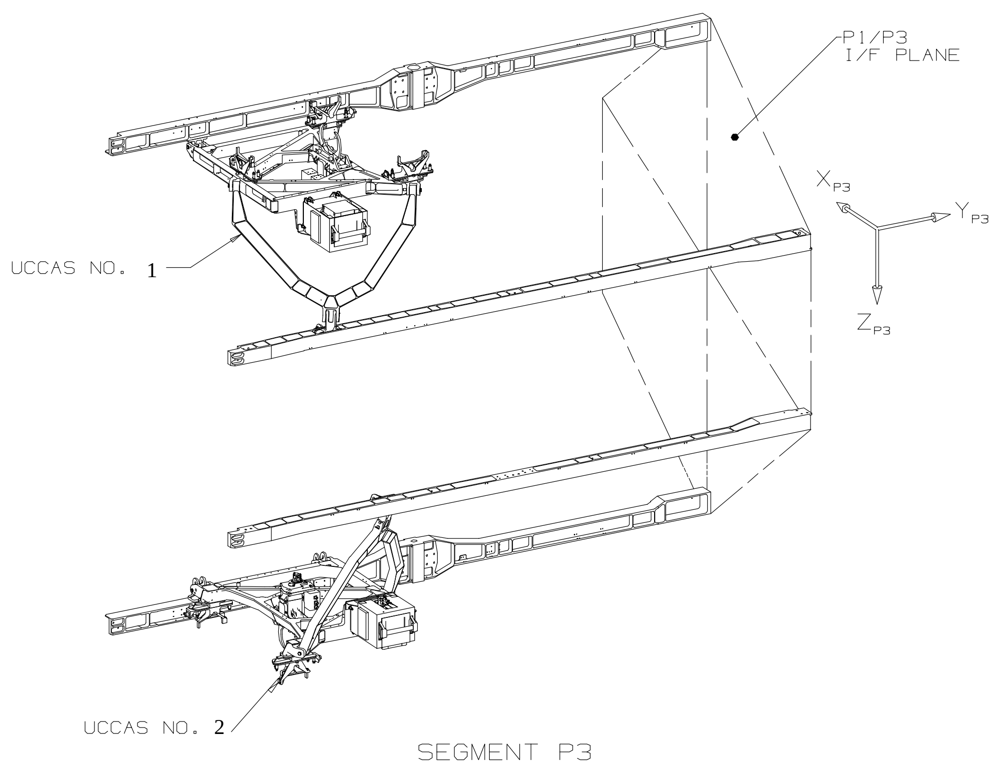



**FIGURE 3.1.2–2 ITS P3 UCCAS ATTACH SITES**

### 3.1.2.1 ACTIVE PAYLOAD ATTACH SYSTEM

The PAS is that portion of ITS S3 that has direct physical contact with the *[Attached Payload Name]*. The active PAS design is controlled by SP–M–602, Configuration Item Specification for the Payload Attach System. The primary components of the active PAS interface are: active UMA, Capture Latch Assembly (CLA) and three guide vanes to support robotic Attached Payload installation and berthing. Figure 3.1.2.1–1 illustrates the active PAS and Figure 3.1.2.1–2 shows the active PAS interface dimensions and defines the location of the local coordinate system origin for the PAS.

The UCCAS is that portion of ITS P3 that has direct physical contact with the ULCs and Attached Payloads. A UCCAS unit is similar to the PAS and can be represented by the same figures as the PAS since the interface to the payload is identical. The only functional difference between the S3/PAS and P3/UCCAS is that the P3/UCCAS is designed with redundant Integrated Motor Control Assemblies (IMCAs) in both its CLA and UMA. The local coordinate system origin point for the S3 PAS and P3 UCCAS sites defined with respect to the ISS coordinate system is shown in Table 3.1.4.1–1.

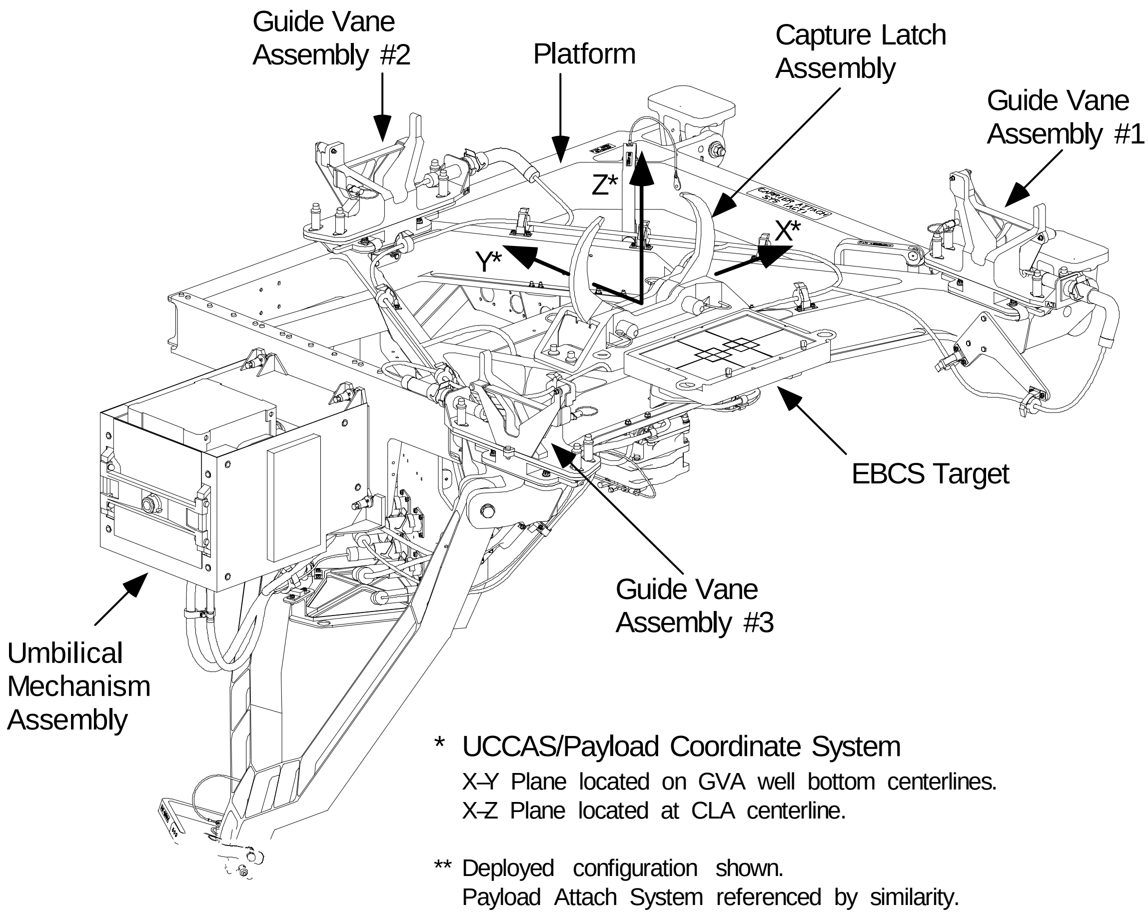



**FIGURE 3.1.2.1–1 ACTIVE PAS**

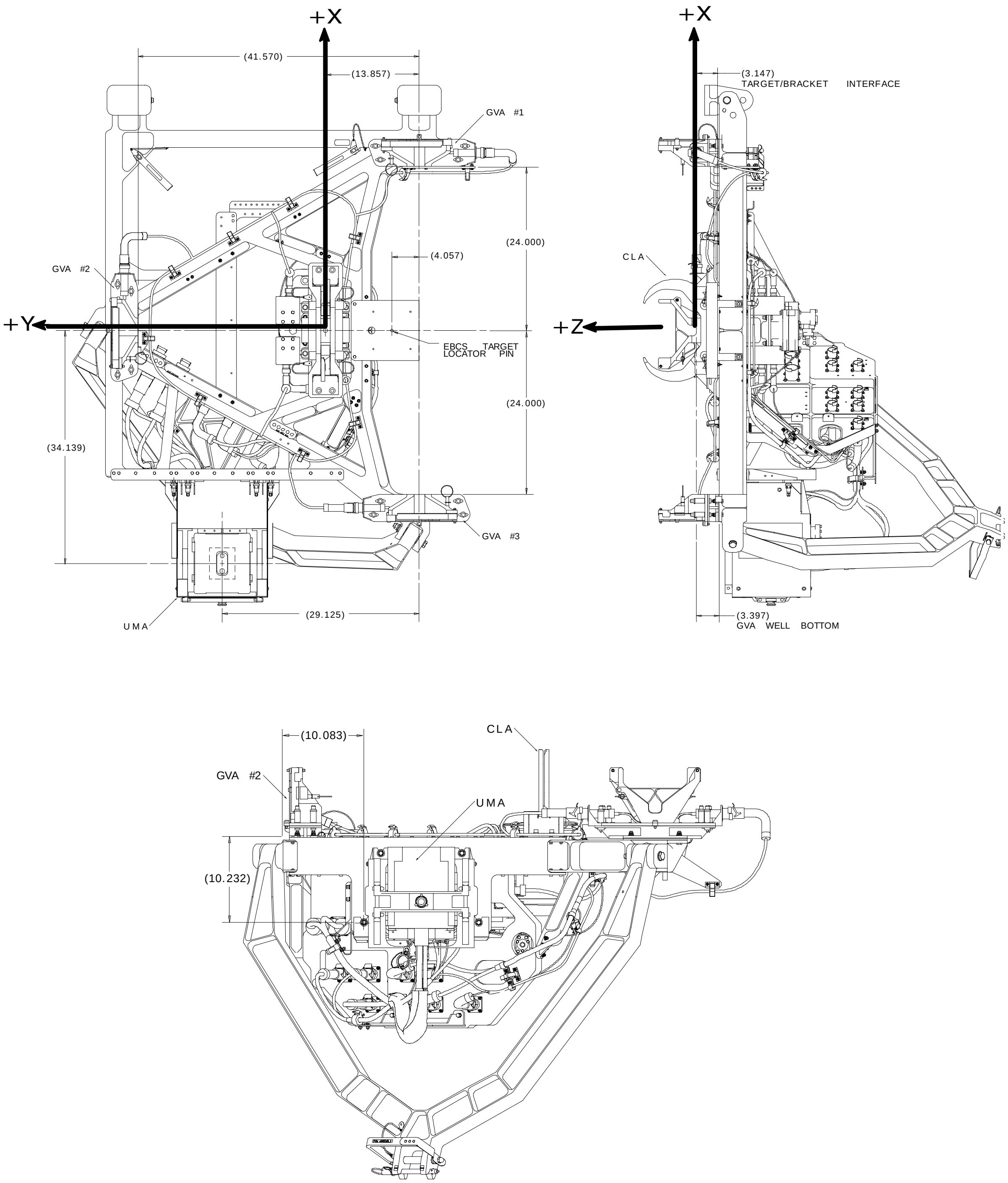



**FIGURE 3.1.2.1–2 PAS STRUCTURAL DIAGRAM**

### 3.1.2.2 *[ATTACHED PAYLOAD NAME]* PASSIVE PAS

Attached Payloads interfacing directly to the PAS/UCCAS will be required to provide interfaces meeting the ISS specifications. For the purposes of this ICD, the Attached Payload portion of the interface will be termed the passive PAS. As a minimum, each passive PAS will include an Extravehicular Activity (EVA) releasable and removable capture bar assembly interfacing to the CLA, three guide pins interfacing to three guide vanes, a passive UMA mounting bracket to maintain the proper component positioning and to react transfer loads, and an EBCS camera to support SSRMS berthing operations. Size, surface finish, and location of the capture bar, guide pins, passive UMA and EBCS camera mounting brackets must be as defined in Figure 3.1.2.2–1. Access to ISS power and data systems will require the provision of a passive UMA mounted to its mounting bracket. The *[Attached Payload Name]* interface geometry is fully defined in Figure 3.1.2.2–2.

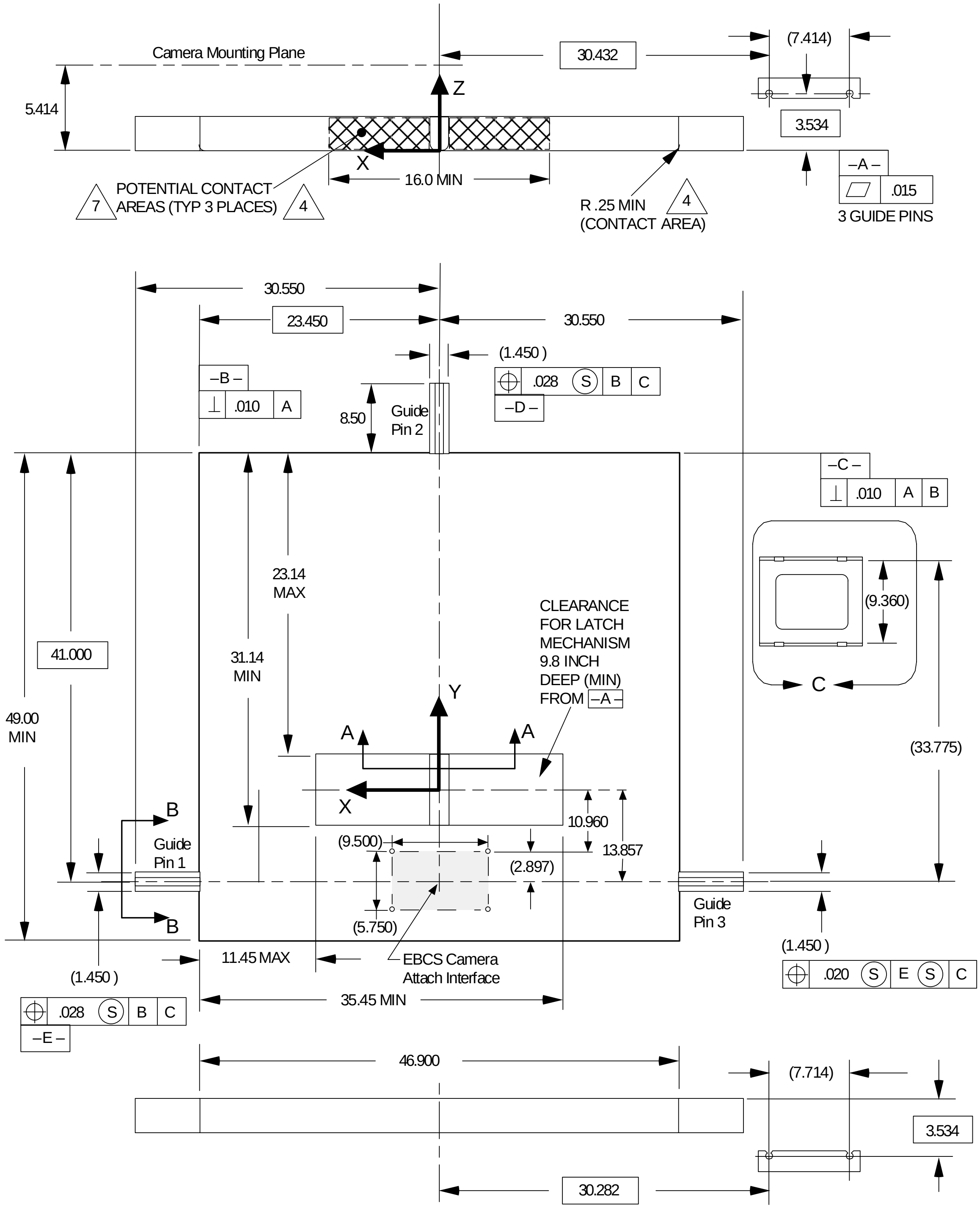
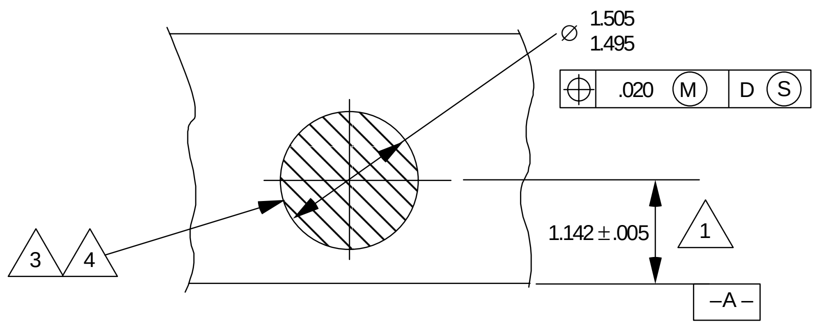
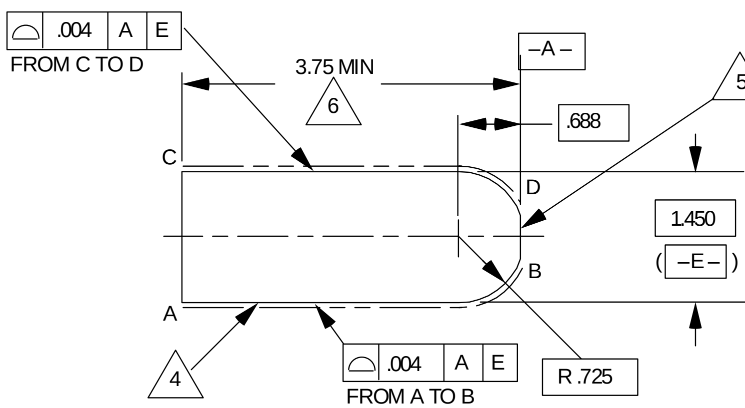



**FIGURE 3.1.2.2–1 PASSIVE PAS/UCCAS GEOMETRY (1 OF 3)**




**SECTION A – A**
**(CAPTURE BAR)**




**VIEW B – B**
**(GUIDE PIN DETAIL – TYPICAL 3 PLACES)**

1. DIMENSION IS BASED ON SYSTEM PRELOAD REQUIREMENT IN SSP 57003, PARAGRAPH 3.1.3.1.3.1.
2. SEE SSP 57003, FIGURE 3.1.3.1.1.1–1 FOR THE ENTIRE PASSIVE HALF OPERATIONAL ENVELOPE.
3. SURFACE ROUGHNESS 63 MICROINCHES PER ANSI B46.1–1985.
4. APPLY MIL–L–46010, TYPE 1 LUBRICANT OR NASA APPROVED EQUIVALENT.
5. GUIDE PIN TO GVA INTERFACE. ELECTRICAL BOND PER SSP 57003, PARAGRAPH 3.2.2.4.2.
6. APPLIES TO HEIGHT OF GUIDE PIN ONLY.
7. MINIMUM PLATFORM HEIGHT IN THIS AREA IS 2.0 INCHES. PLATFORM DESIGN IS DEPENDENT UPON SYSTEM PRELOAD REQUIREMENT IN SSP 57003, PARAGRAPH 3.1.3.1.3.1.

**FIGURE 3.1.2.2–1 PASSIVE PAS/UCCAS GEOMETRY (2 OF 3)**

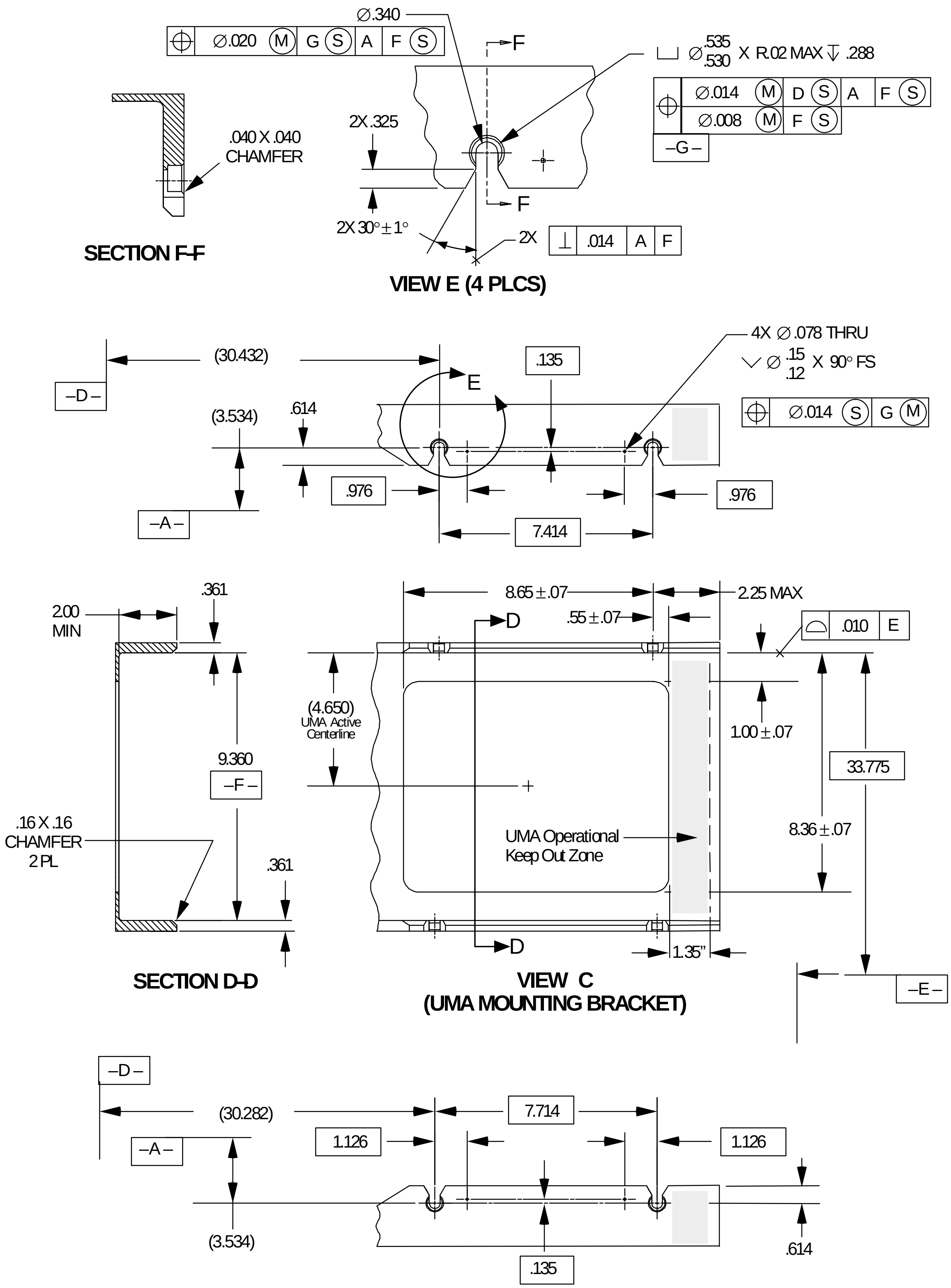



**FIGURE 3.1.2.2–1 PASSIVE PAS/UCCAS GEOMETRY (3 OF 3)**

> Note: The Attached Payload developer will provide drawings showing dimensions, tolerances, and finishes that fully define the geometry of the passive PAS as provided in Figure 3.1.2.2–1.

**FIGURE 3.1.2.2–2 [ATTACHED PAYLOAD NAME] PASSIVE PAS GEOMETRY**

### 3.1.2.3 CAPTURE LATCH ASSEMBLY

Each active PAS/UCCAS includes one CLA. The design of the CLA is controlled by SP–M–600, Configuration Item Specification for the Capture Latch Assembly. The CLA is a remotely actuated mechanism supporting capture, berthing and structural integration of the Attached Payload to the PAS. Each CLA consists of a pair of latch jaws that are driven open and closed by a standard DC IMCA. The CLA operates in conjunction with the three guide vanes located on the PAS/UCCAS. The guide vanes maintain proper alignment of the guide pins as the Attached Payload is drawn into final position. The operational sequence for capture of the Attached Payload by the PAS/UCCAS is shown in Figures 3.1.2.3–1, 1 through 10. The drawings and dimensions in Figures 3.1.2.3–1, 1 through 10, are for reference only.

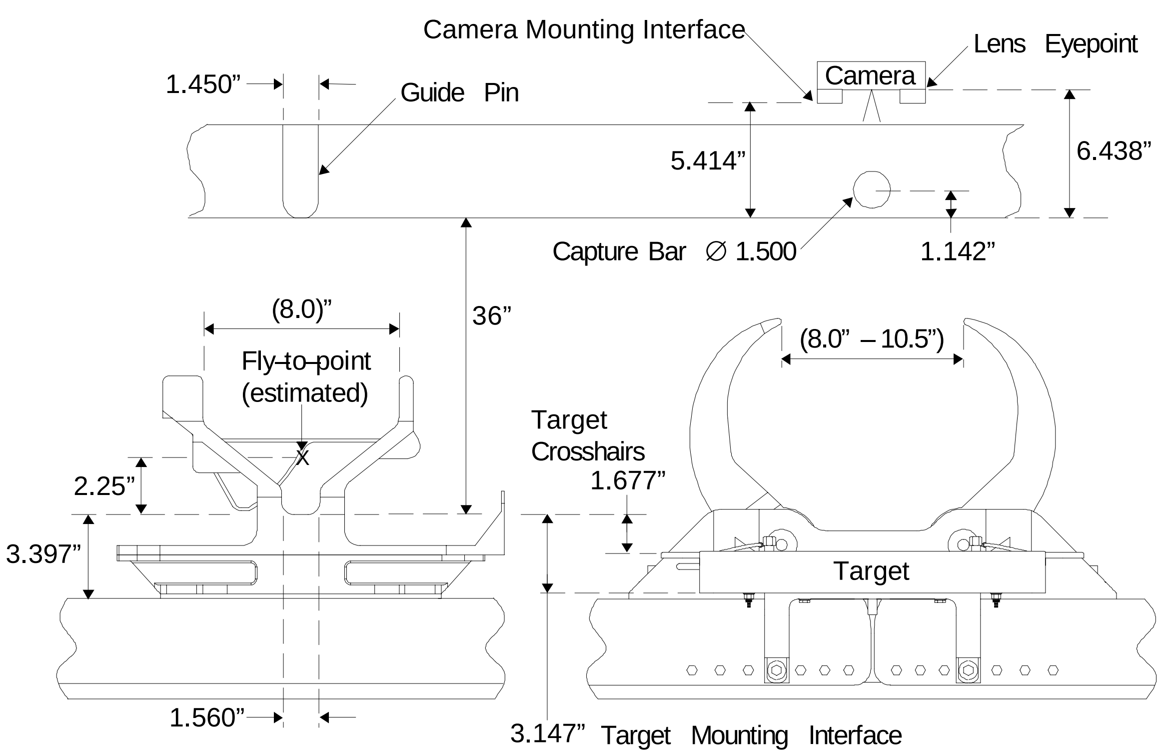



**FIGURE 3.1.2.3–1 OPERATIONAL SEQUENCE – PRE INSTALL POSITION (1 OF 10)**

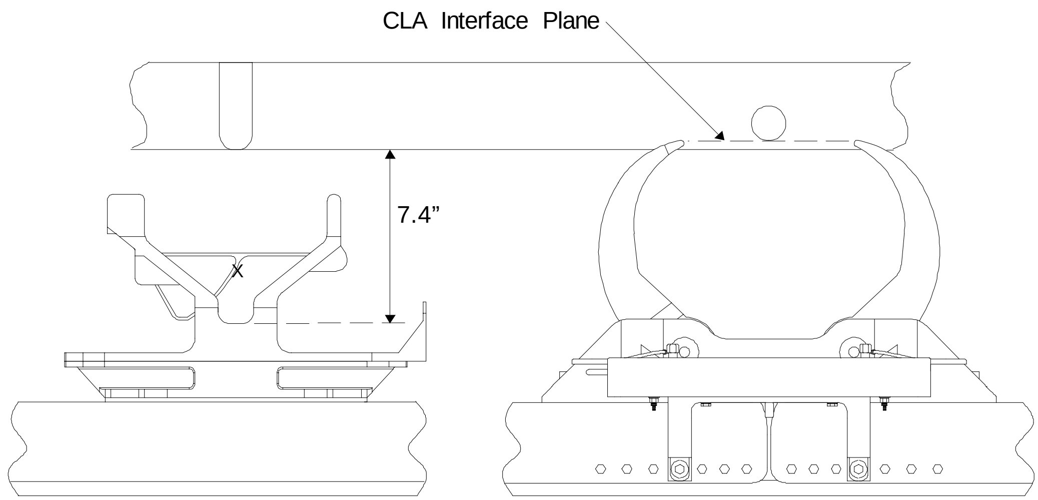



**FIGURE 3.1.2.3–1 OPERATIONAL SEQUENCE – CLA HARDWARE INTERFACE PLANE (2 OF 10)**

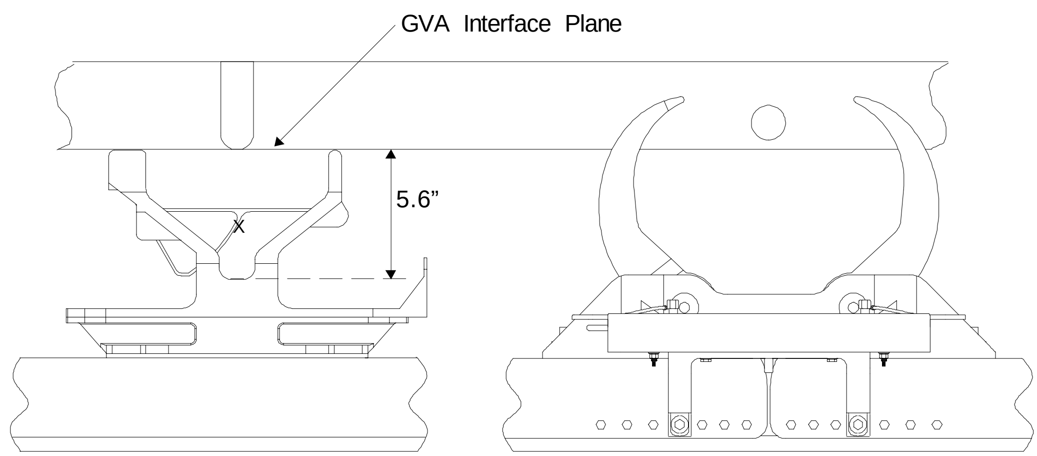



**FIGURE 3.1.2.3–1 OPERATIONAL SEQUENCE – GVA HARDWARE INTERFACE PLANE (3 OF 10)**

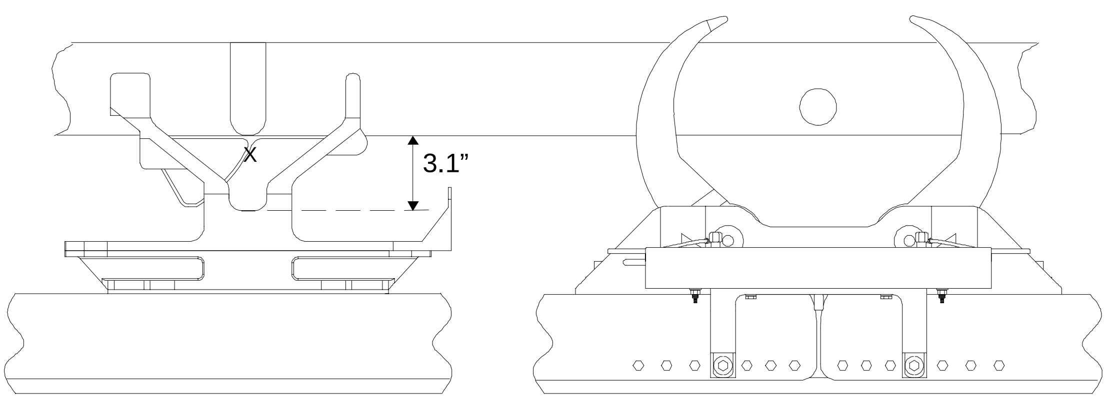



**FIGURE 3.1.2.3–1 OPERATIONAL SEQUENCE – RTL SENSOR GATE CONTACT (4 OF 10)**

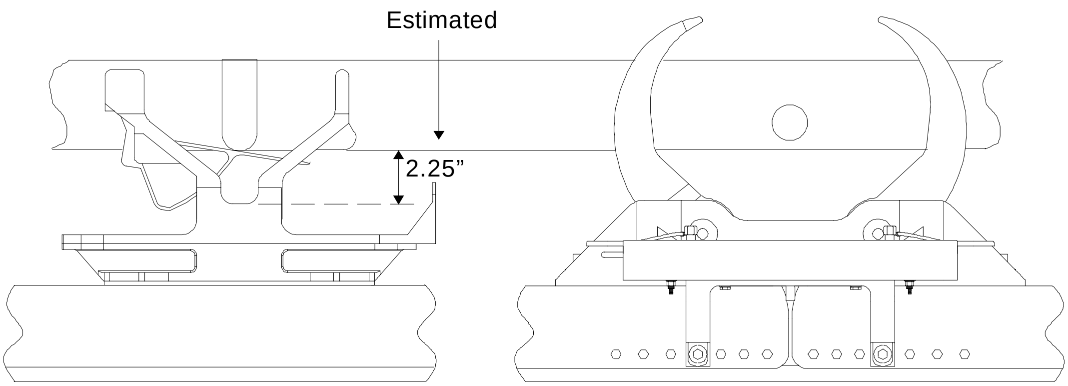



**FIGURE 3.1.2.3–1 OPERATIONAL SEQUENCE – FLY TO POINT (RTL INDICATION) (5 OF 10)**

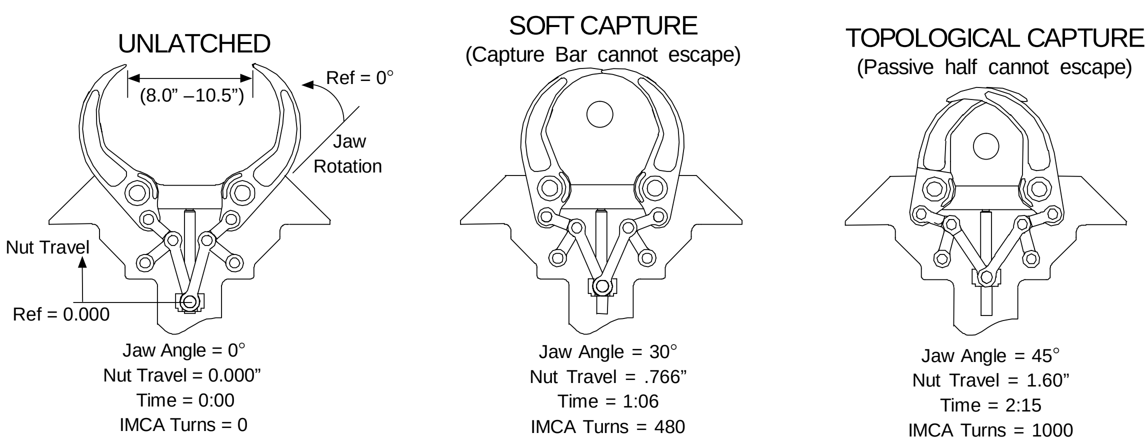



**FIGURE 3.1.2.3–1 OPERATIONAL SEQUENCE – LATCHING PHASE I (6 OF 10)**

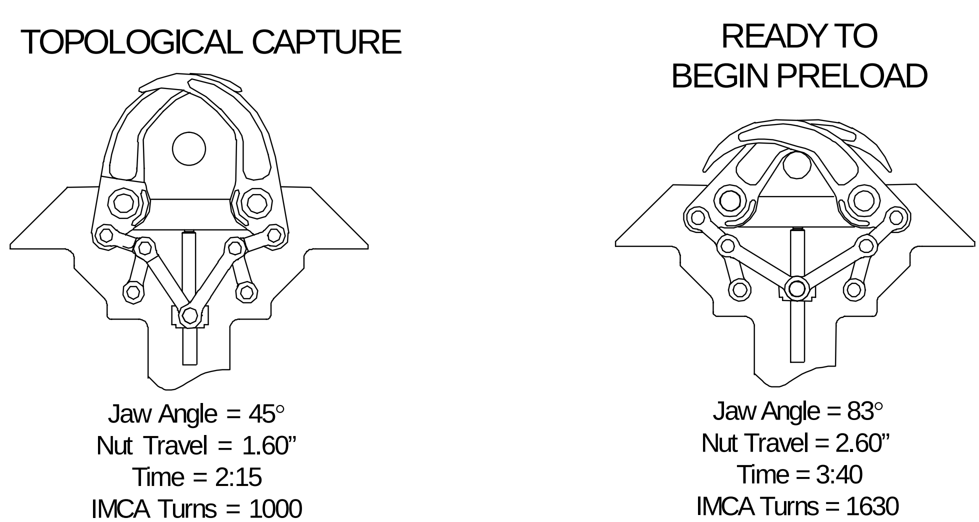



**FIGURE 3.1.2.3–1 OPERATIONAL SEQUENCE – LATCHING PHASE II (7 OF 10)**

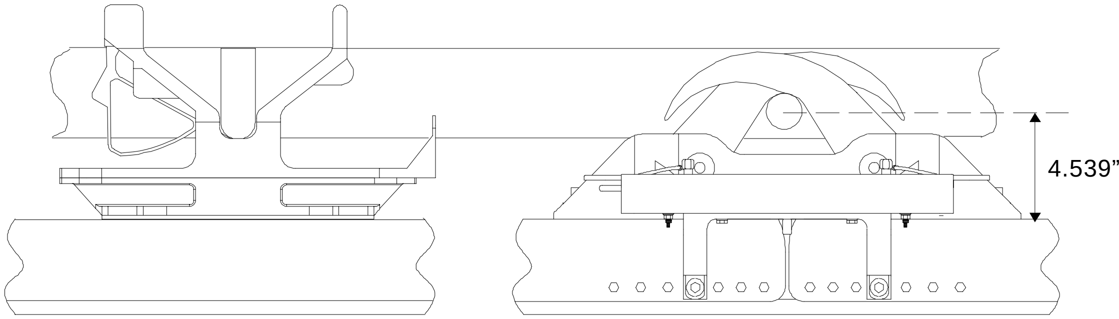
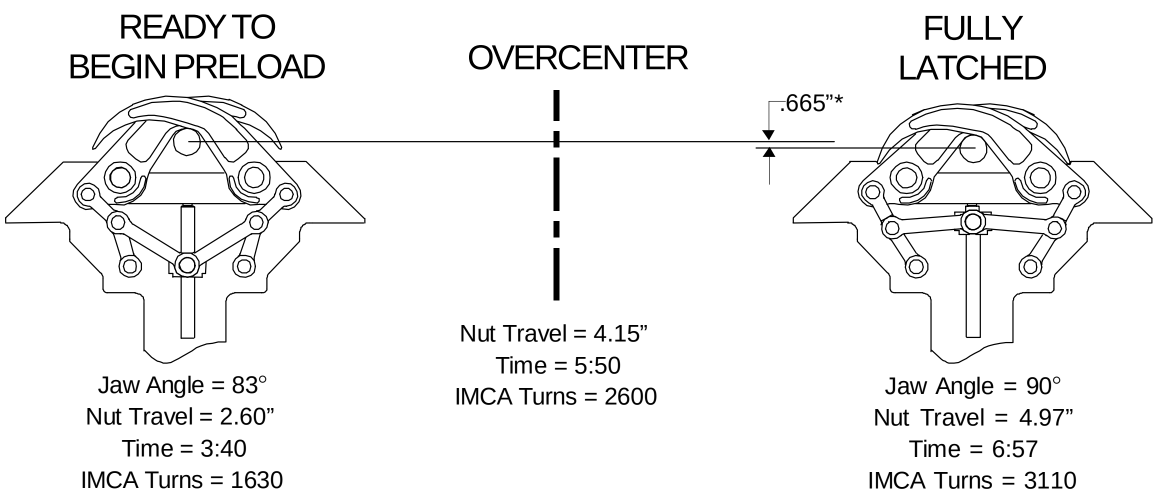



**FIGURE 3.1.2.3–1 OPERATIONAL SEQUENCE – FULLY SEATED (NO PRELOAD) (8 OF 10)**




* = .665” is nominal system deflection (.419” for Passive Half, .246” for Active Half)

**FIGURE 3.1.2.3–1 OPERATIONAL SEQUENCE – LATCHING PHASE III (9 OF 10)**

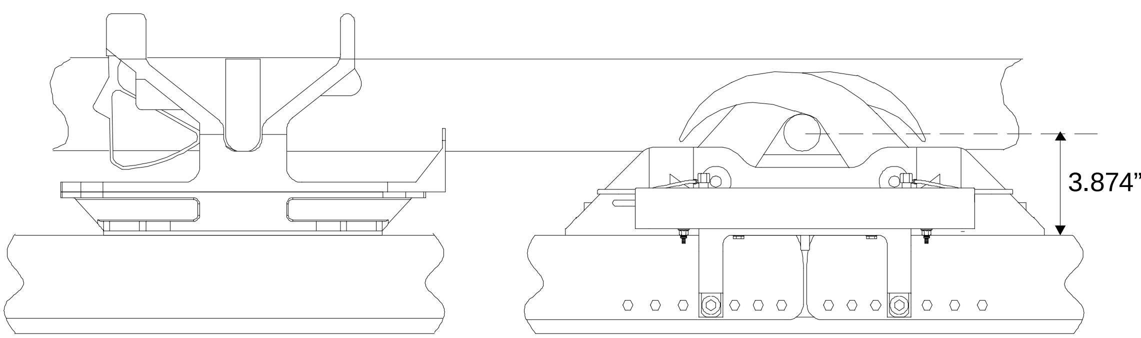



**FIGURE 3.1.2.3–1 OPERATIONAL SEQUENCE – FULLY LOADED (10 OF 10)**

### 3.1.2.4 *[ATTACHED PAYLOAD NAME]* EVA RELEASABLE AND REMOVABLE CAPTURE BAR

The *[Attached Payload Name]* design includes an EVA releasable and removable capture bar to interface with the PAS/UCCAS CLA. The EVA releasable capture bar design and location are in accordance with SSP 50005, ISSA Flight Crew Integration Standard. Reference Figure 3.1.2.2–1 for capture bar dimensions and tolerances. The *[Attached Payload Name]* EVA releasable capture bar is shown in Figure 3.1.2.4–1.

> Note: The Attached Payload developer will provide drawings showing dimensions, tolerances, materials, finishes, etc. that fully describe the design and functionality of the EVA releasable capture bar in Figure 3.1.2.4–1.

**FIGURE 3.1.2.4–1 *[ATTACHED PAYLOAD NAME]* EVA RELEASABLE AND REMOVABLE CAPTURE BAR**

### 3.1.2.5 GUIDE VANES

The active PAS/UCCAS has three guide vanes that interface with the three guide pins on the *[Attached Payload Name]* passive PAS. The design of the guide vanes is controlled by SP–M–602. The guide vanes and pins are capable of passive guidance and fine alignment for an Attached Payload being drawn into final position by the CLA. The guide vanes include Ready–To–Latch (RTL) indicators providing positive feedback to SSRMS operators that the Attached Payload is properly positioned within the CLA capture envelope prior to CLA activation. Figure 3.1.2.5–1 shows the guide vane design.

### 3.1.2.6 *[ATTACHED PAYLOAD NAME] GUIDE PIN DESIGN*

The *[Attached Payload Name]* has three guide pins integral to the passive PAS/UCCAS to interface with the PAS/UCCAS active half guide vanes. Reference Figure 3.1.2.2–1 for guide pin dimensions and tolerances. The *[Attached Payload Name]* guide pin design is shown in Figure 3.1.2.6–1.

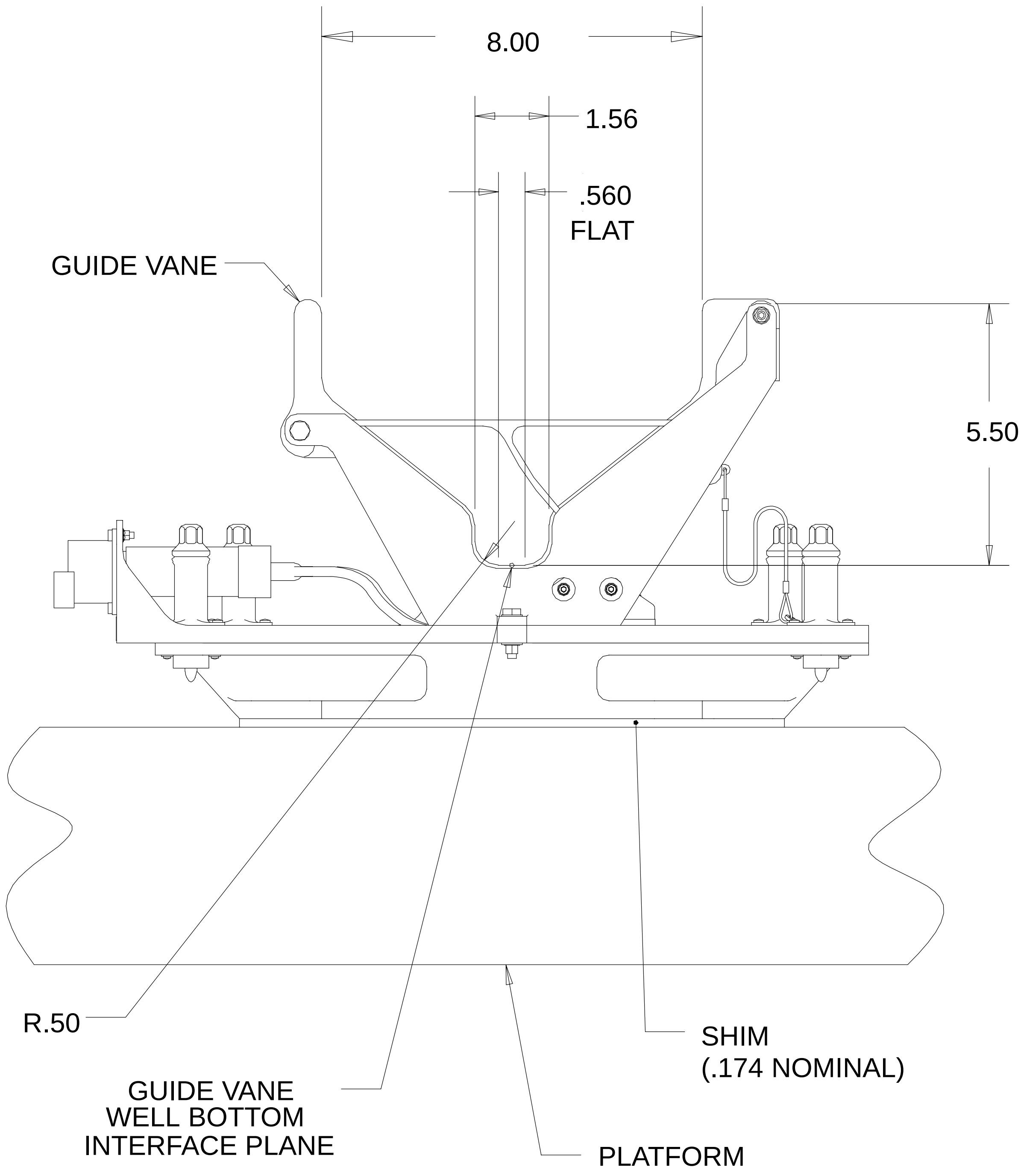



**FIGURE 3.1.2.5–1 GUIDE VANES**

> Note: The Attached Payload developer will provide drawings showing dimensions, tolerances, and finishes of the guide pins in Figure 3.1.2.6–1.
> Note: If this geometric data is provided on Figure 3.1.2.2–2 reference may be made to that figure.

**FIGURE 3.1.2.6–1 *[ATTACHED PAYLOAD NAME]* GUIDE PIN DESIGN**

### 3.1.2.7 ACTIVE UMBILICAL MECHANISM ASSEMBLY

Each active PAS/UCCAS includes one active UMA. The active UMA is a remotely actuated mechanism supporting connection and disconnection of Attached Payloads to ISS power and data systems. The design of the active UMA is controlled by SP–M–601, Configuration Item Specification for the Umbilical Mechanism Assembly. The active UMA design is shown in Figure 3.1.2.7–1.

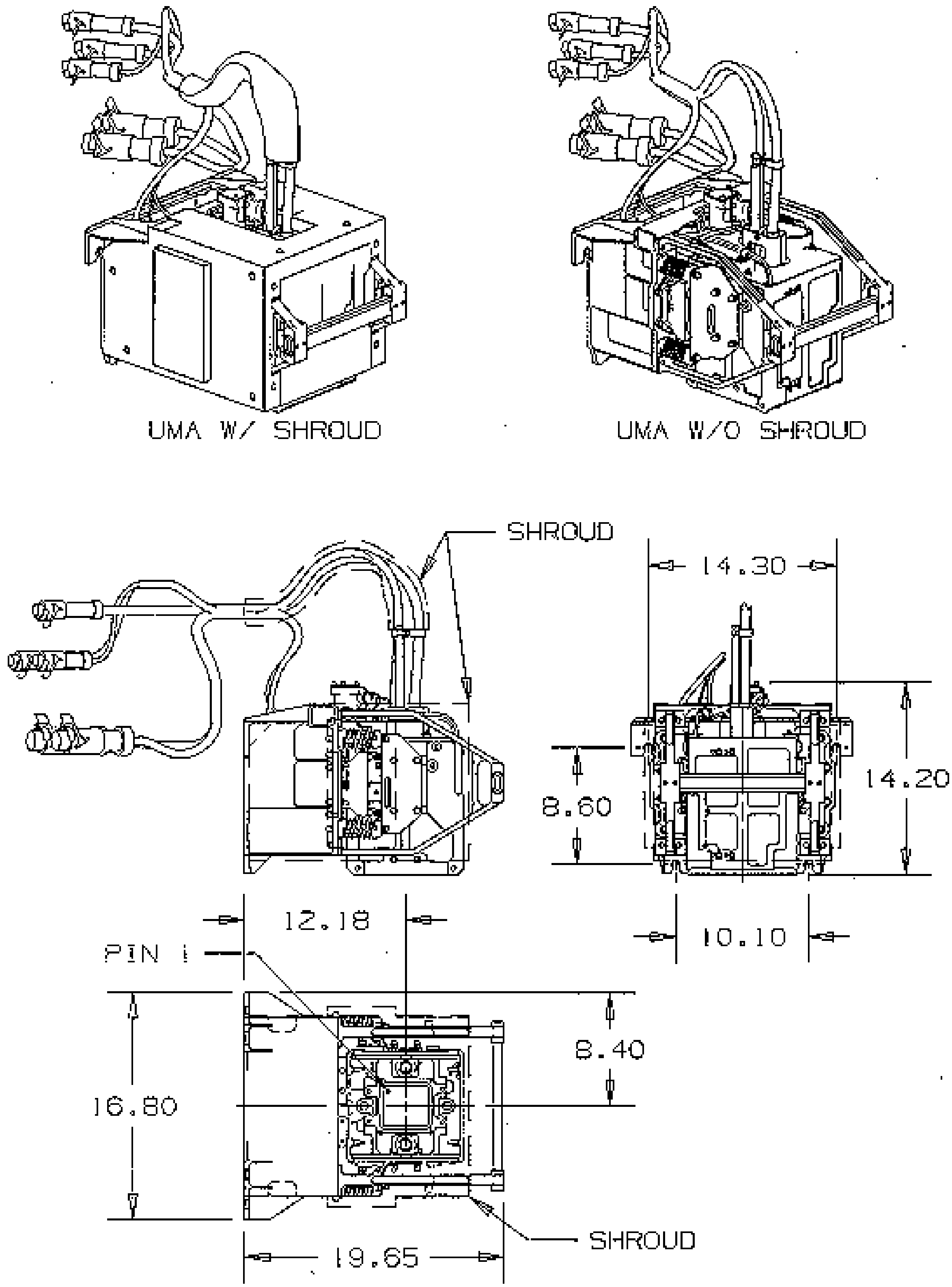



**FIGURE 3.1.2.7–1 ACTIVE UMA**

### 3.1.2.8 PASSIVE UMA

The passive UMA is designed and manufactured by the Boeing Company for NASA and can be provided to the Attached Payload developer. The passive UMA, P/N 1F70162–1, for both the PAS and the UCCAS may be procured by the payload developer. The passive UMA is an ORU that contains the female connector, debris shield, and an interlocking system that reacts loads with the active UMA (see SSQ 21637, Connectors and Accessories, Electrical, Umbical Interface, Environmental Space Quality, General Specification). The passive UMA provides an interface for the payload power and data connection and meets the requirements of SSQ 21637. The passive UMA provides 385 inches +/–24 inches of cable for connection to the attached payload as shown in Figure 3.2.1–2. In addition, the passive UMA is capable of achieving berthing with the contact conditions and misalignments defined in SSP 42131, Space Station Program Integrated Truss Segment P3 and S3 to Attached Payloads and Unpressurized Cargo Carriers (UCC) Standard Interface Control Document. The passive UMA is accessible for manual EVA backup operation in accordance with SSP 50005, paragraph 12.3. A representation of a passive UMA is shown in Figure 3.1.2.8–1, for illustrative purposes only. A representation of the active and passive UMAs prior to engagement is shown in Figure 3.1.2.8–2, for illustrative purposes only.

> Note: The Attached Payload developer will replace Figure 3.1.2.8–1 with drawings showing dimensions, tolerances, materials, finishes, etc. that fully describe the design and functionality of the passive UMA if P/N 1F70162–1 is not used.

### 3.1.3 PHYSICAL ENVELOPE

#### 3.1.3.1 *[ATTACHED PAYLOAD NAME]* INSTALLATION AND TRANSLATION ENVELOPE

The *[Attached Payload Name]* and associated equipment does not exceed the maximum allowable installation envelope. The installation envelope is defined by the extreme physical envelope of the Attached Payload while being transported by the SRMS, SSRMS and MSS and while being robotically installed on the S3 PAS or the P3 UCCAS. A representation of an installation envelope shown in Figure 3.1.3.1–1 is provided for illustrative purposes only.

#### 3.1.3.2 INTERFACE PLANE

The *[Attached Payload Name]* and associated equipment other than the keel trunnion do not protrude past the PAS interface plane as shown in Figure 3.1.3.2–1.

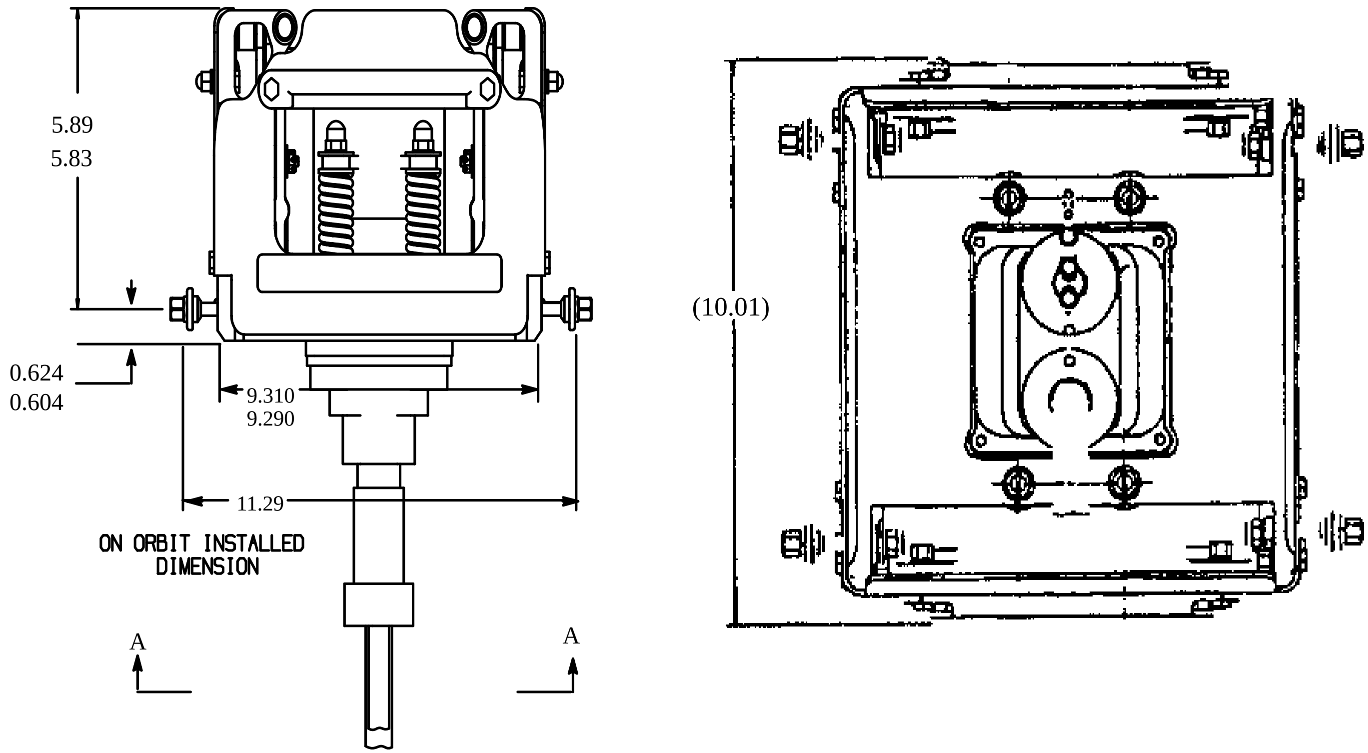



**FIGURE 3.1.2.8–1 PASSIVE UMA DESIGN**

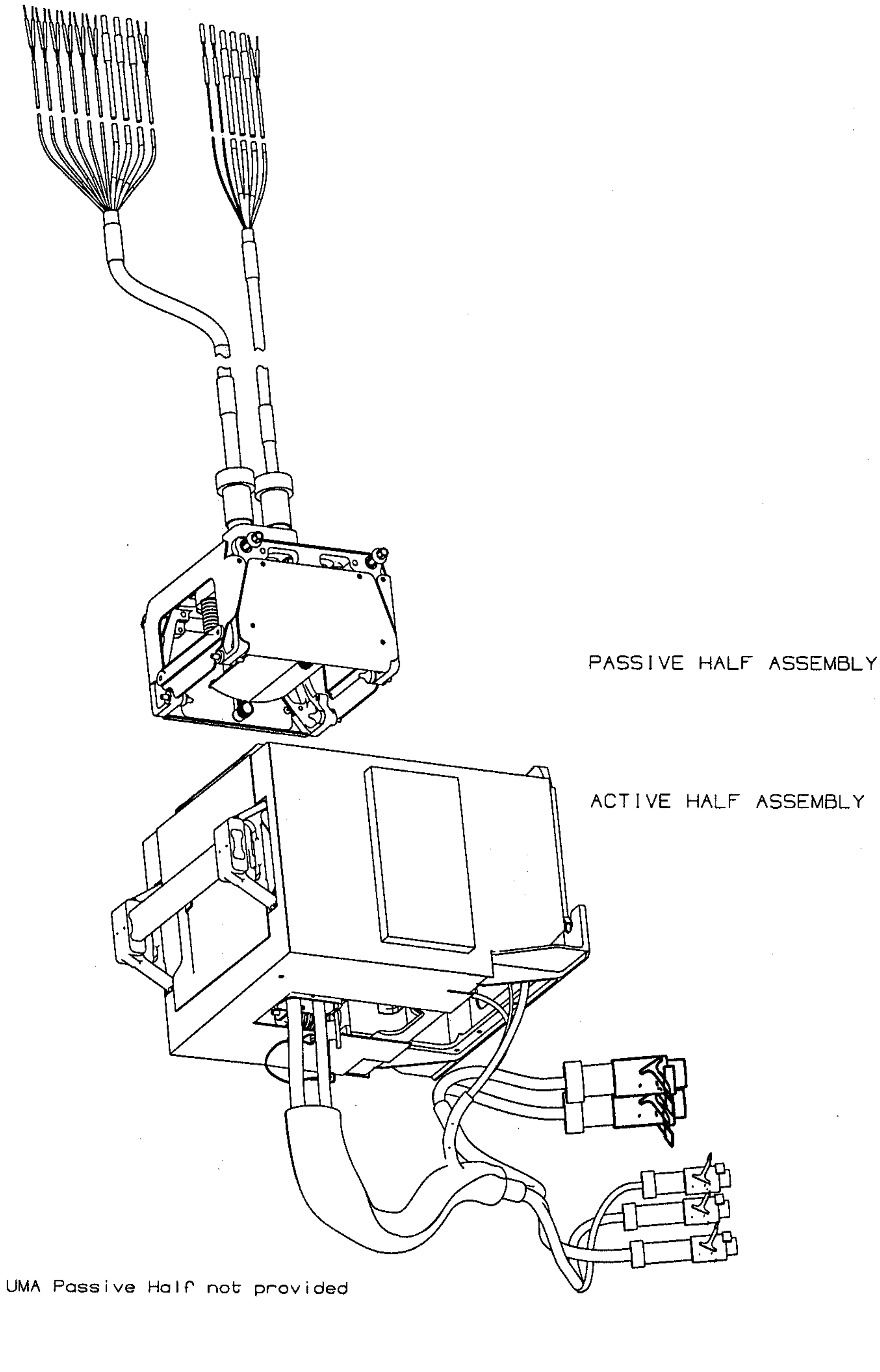



**FIGURE 3.1.2.8–2 UMBILICAL MECHANISM ASSEMBLY**

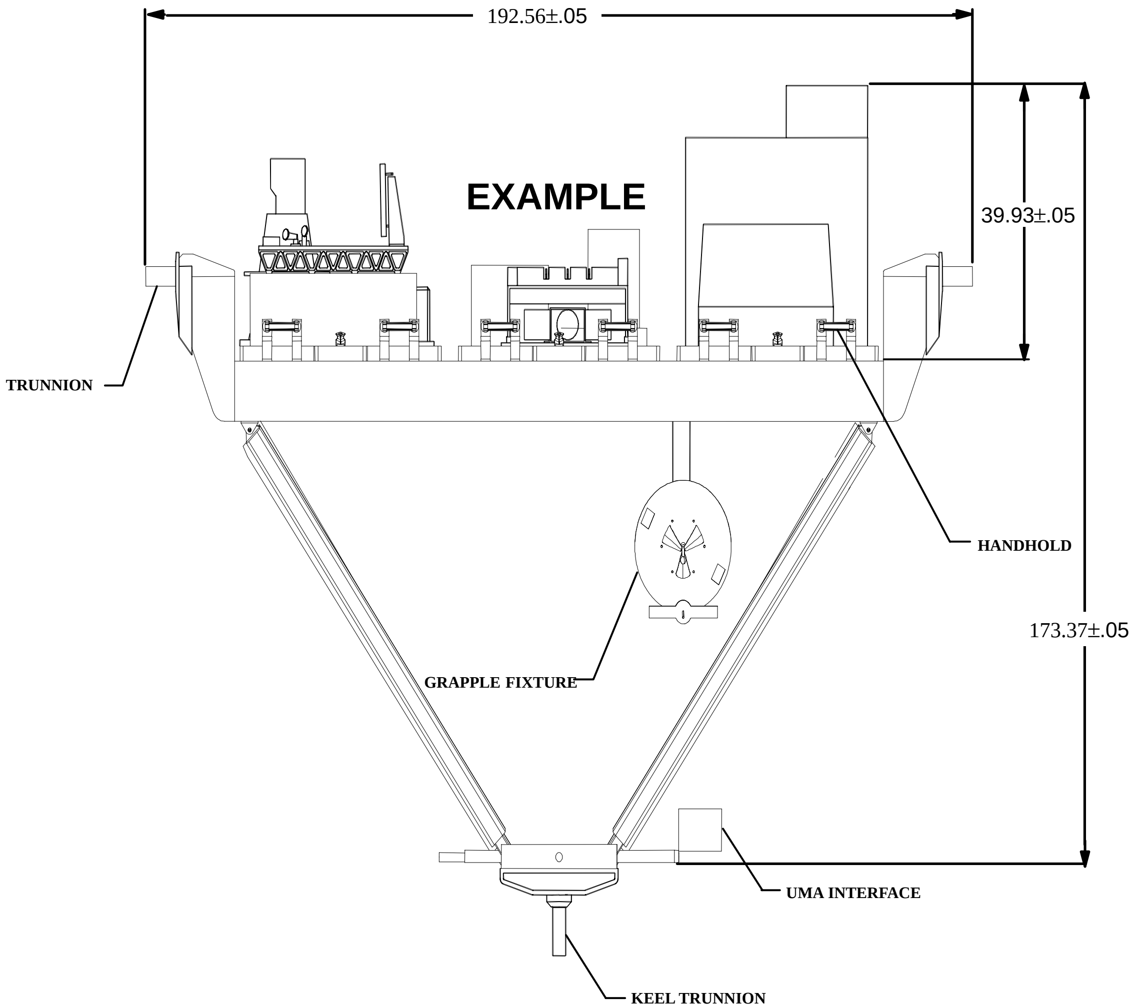



**FIGURE 3.1.3.1–1 *[ATTACHED PAYLOAD NAME]* INSTALLATION AND TRANSLATION ENVELOPE (PAGE 1 OF 2)**

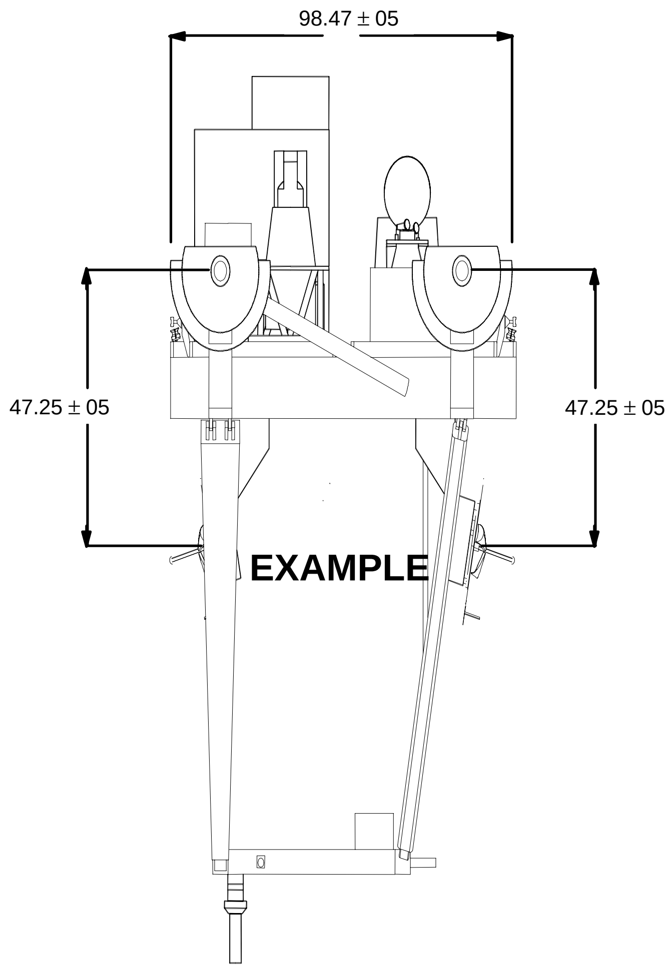



**FIGURE 3.1.3.1–1 *[ATTACHED PAYLOAD NAME]* INSTALLATION AND TRANSLATION ENVELOPE (PAGE 2 OF 2)**

> Note: The Attached Payload developer will replace the example drawing in Figure 3.1.3.1–1 that shows SSRMS transfer operations of the Attached Payload do not exceed S3 and P3 installation envelope in accordance with SSP 30256, Extravehicular Activity Standard, and SSP 30550, Space Station Program Robotic Systems Integration Standards, Volume 1.

> Note: The Attached Payload developer will provide a drawing in Figure 3.1.3.2–1 to demonstrate that Attached Payload components except the keel trunnion do not protrude past the PAS interface plane defined by the outer tangent point/line of the three guide pins.

**FIGURE 3.1.3.2–1 [ATTACHED PAYLOAD NAME] INTERFACE PLANE**

#### 3.1.3.3 *[ATTACHED PAYLOAD NAME]* ON–ORBIT OPERATIONAL ENVELOPE

The *[Attached Payload Name]* on–orbit operational envelope does not exceed the maximum allowable operational envelope. The on–orbit operational envelope shown in Figure 3.1.3.3–1 is provided for illustrative purposes only.

> Note: The Attached Payload developer will provide a dimensioned drawing in Figure 3.1.3.3–1 that demonstrates the maximum on–orbit operational envelope for the Attached Payload.

### 3.1.4 MASS PROPERTIES AND CENTER OF GRAVITY

#### 3.1.4.1 ATTACHED PAYLOAD COORDINATE SYSTEM

The Attached Payload uses the coordinate system defined in SSP 30219, Space Station Reference Coordinate System. The coordinates for the S3 PAS and P3 UCCAS local coordinate system origin locations are defined in Table 3.1.4.1–1 and illustrated on the PAS drawing in Figure 3.1.2.1–1 and 3.1.2.1–2.

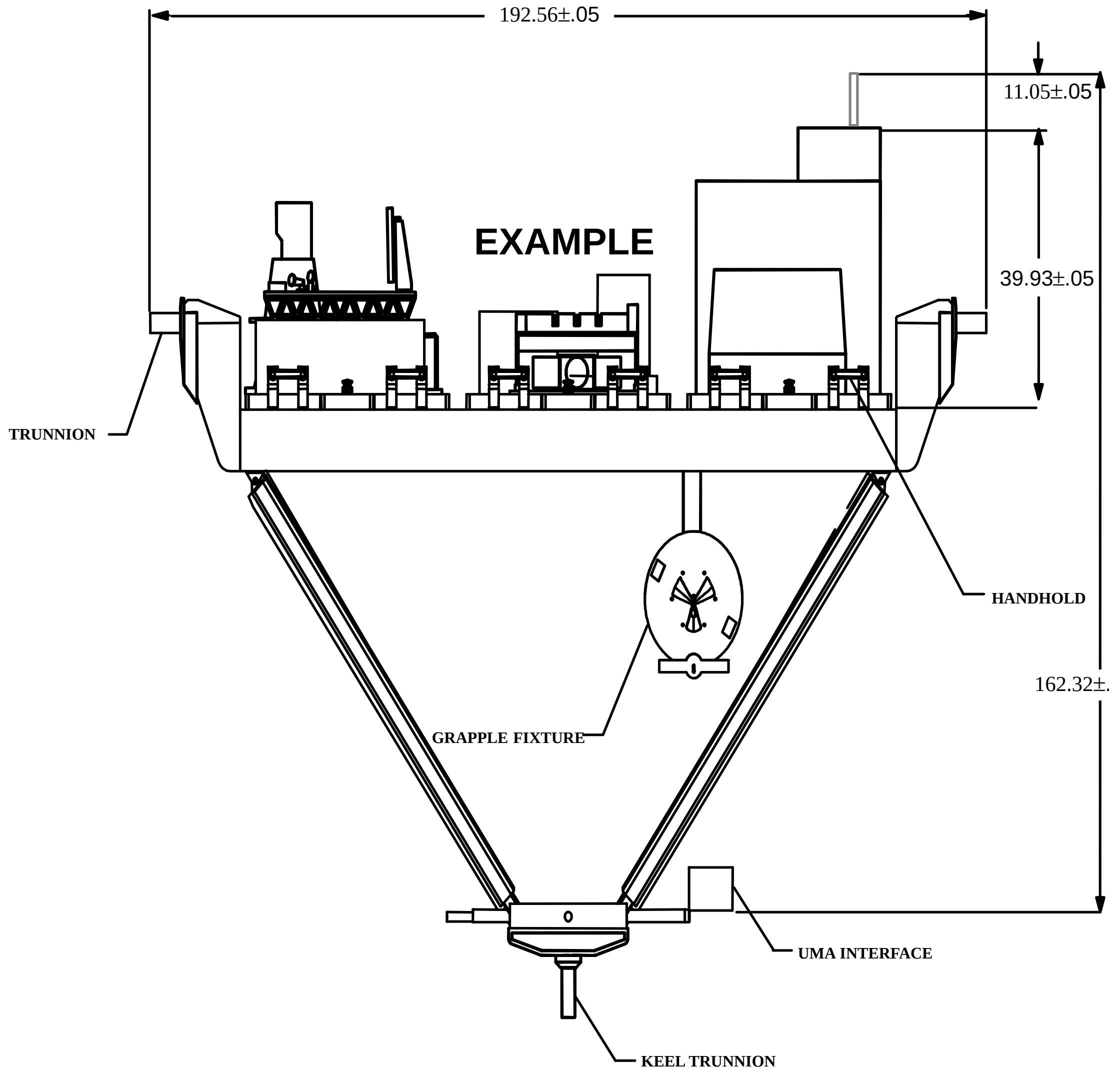



**FIGURE 3.1.3.3–1 *[ATTACHED PAYLOAD NAME]* ON–ORBIT OPERATIONAL ENVELOPE (PAGE 1 OF 2)**

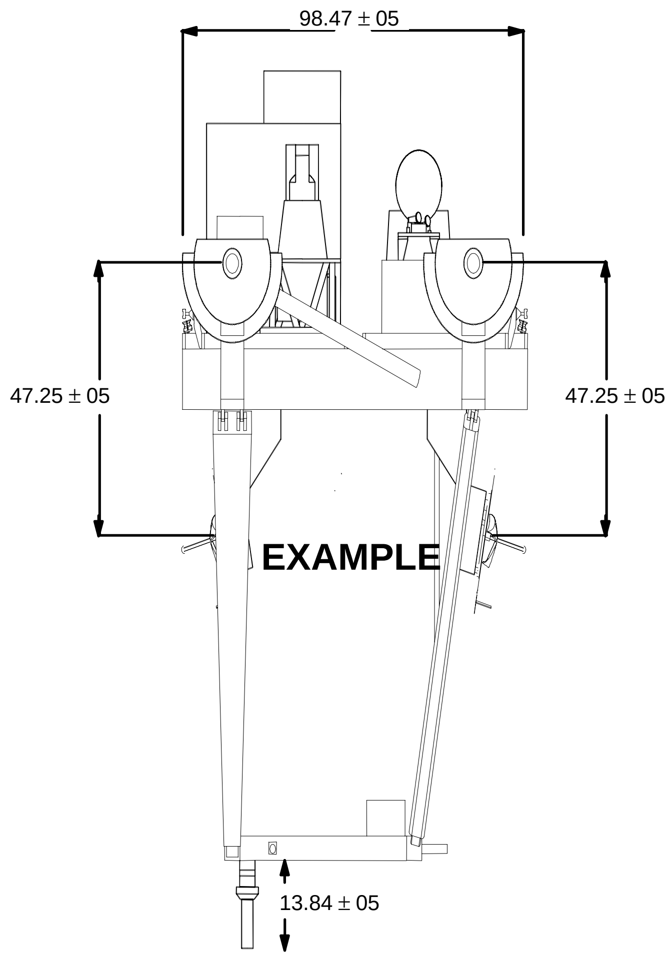



**FIGURE 3.1.3.3–1 *[ATTACHED PAYLOAD NAME]* ON–ORBIT OPERATIONAL ENVELOPE (PAGE 2 OF 2)**

**TABLE 3.1.4.1–1 PAS AND UCCAS LOCAL COORDINATE SYSTEM ORIGIN LOCATIONS**

| Name | Location (inches) | | |
|---|---|---|---|
| S3, PAS 1 | $X_{S3}$ = –33.701 | $Y_{S3}$ = +266.702 | $Z_{S3}$ = –80.927 |
| S3, PAS 2 | $X_{S3}$ = –33.701 | $Y_{S3}$ = +153.332 | $Z_{S3}$ = –80.927 |
| S3, PAS 3 | $X_{S3}$ = –33.701 | $Y_{S3}$ = +252.998 | $Z_{S3}$ = +80.927 |
| S3, PAS 4 | $X_{S3}$ = –33.701 | $Y_{S3}$ = +137.641 | $Z_{S3}$ = +80.927 |
| P3, UCCAS 1 | $X_{P3}$ = –33.701 | $Y_{P3}$ = –252.998 | $Z_{P3}$ = –80.927 |
| P3, UCCAS 2 | $X_{P3}$ = –33.701 | $Y_{P3}$ = –266.702 | $Z_{P3}$ = +80.927 |

Notes:

1. The X, Y and Z values define the location of the PAS/UCCAS local coordinate system in terms of its respective ITS S3/P3 coordinate system.
2. The ITS S0 local coordinate system origin is located +/– 700.968” in the Y direction, respectively, from the ITS S3/P3 local coordinate system origin.

### 3.1.4.2 CONTROL WEIGHT

The *[Attached Payload Name]* total on–orbit control weight, including facility carrier and payload experiments is provided in Table 3.1.4.2–1.

> Note: The Attached Payload developer will record the maximum control weight of the on–orbit Attached Payload including the facility carrier and payload experiments in Table 3.1.4.2–1.

**TABLE 3.1.4.2–1 CONTROL WEIGHT**

| **Attached Payload** | **Weight (lbs.)** |
|---|---|
| *[Attached Payload Name]* | |

### 3.1.4.3 CONTROL CENTER OF GRAVITY

The *[Attached Payload Name]* on–orbit control center of gravity, including the facility carrier and payload experiments, is provided in Table 3.1.4.3–1. The center of gravity accounts for variations, locations and articulating (dynamic) effects of payloads on the *[Attached Payload Name]*.

> Note: The Attached Payload developer will record (X, Y, Z inches) the location of the maximum center of gravity of the Attached Payload in Table 3.1.4.3–1 below.

**TABLE 3.1.4.3–1 CONTROL CENTER OF GRAVITY ENVELOPE**

| Axis | Center of Gravity Envelope |
|---|---|
| X | |
| Y | |
| Z | |

Note: Center of gravity is relative to the Attached Payload local coordinate system defined in Figure 3.1.2.1–2.

### 3.1.5 UNIQUE INTERFACES

> Note: This section is reserved for the Attached Payload developer to provide the drawings of any unique interfaces such as mechanical stops, safety interlocks, etc. to satisfy the requirements set forth in SSP 57003.

## 3.2 ELECTRICAL POWER INTERFACES

The UMA interface supports the transfer of electrical power to the *[Attached Payload Name]* at a maximum of 25 A between 113 and 126 Volts Direct Current (VDC). The MCAS interface supports the transfer of electrical power to the *[Attached Payload Name]* at a maximum of 12 A between 112.5 and 126 Volts Direct Current (VDC). The UMA interface is capable of providing power across either of two circuits depending upon operational constraints. Availability of power will depend upon stage specific ISS operational constraints.

### 3.2.1 *[ATTACHED PAYLOAD NAME]* CONNECTORS AND PIN ASSIGNMENTS

ISS electrical and Command and Data Handling (C&DH) interfaces terminate in the active UMA connector, NUP1–005, as defined in SSQ 21637. The *[Attached Payload Name]* utilizes the passive UMA connector, NUR1–005, as defined in SSQ 21637. The active UMA connectors and pin assignments are defined in Table 3.2.1–1 to mate with the *[Attached Payload Name]* passive UMA connectors and pin assignments shown in the last two columns of Table 3.2.1–1.

> Note: The Attached Payload developer must record connector part number and the pass through power distribution pin assignments for the passive UMA in Table 3.2.1–1 to define the electrical power interface pinout functions used.

The UMA pin designations are shown in Figure 3.2.1–1.

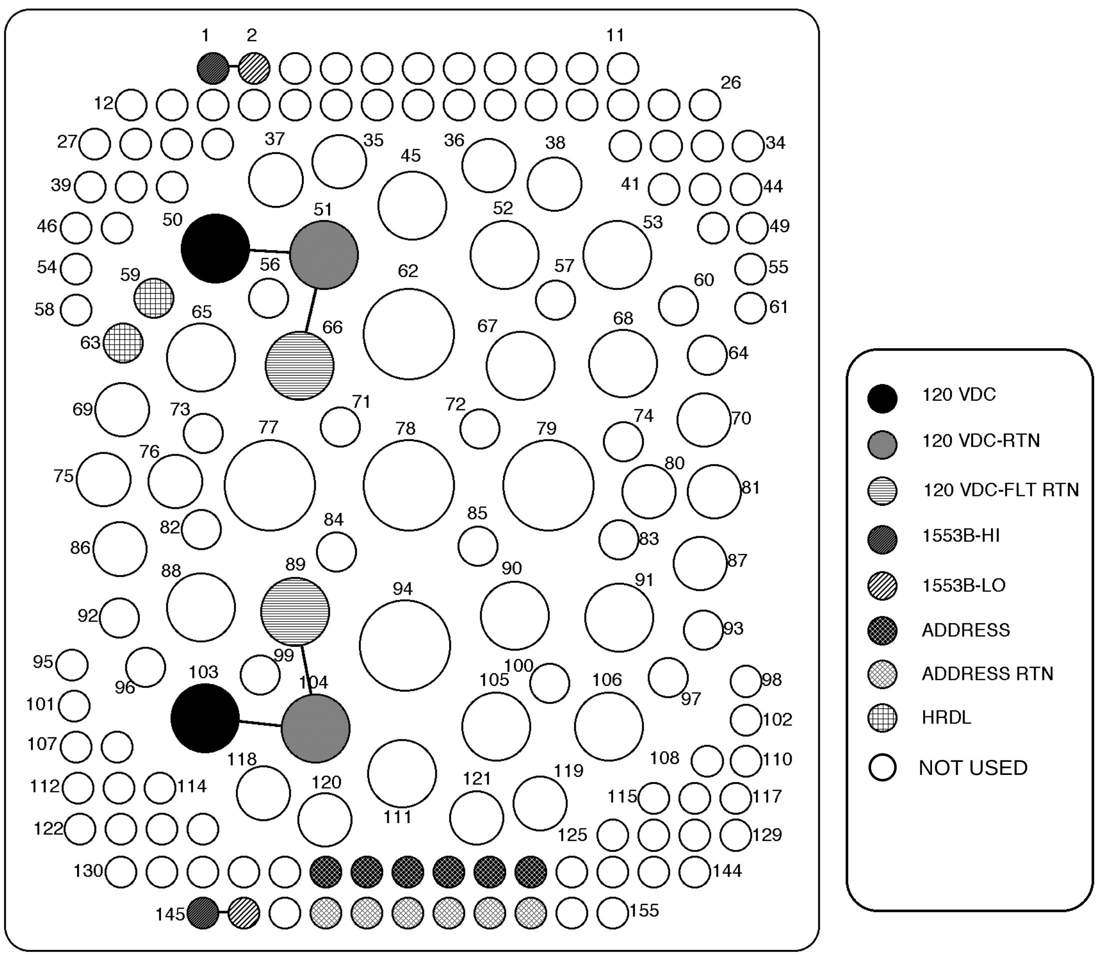
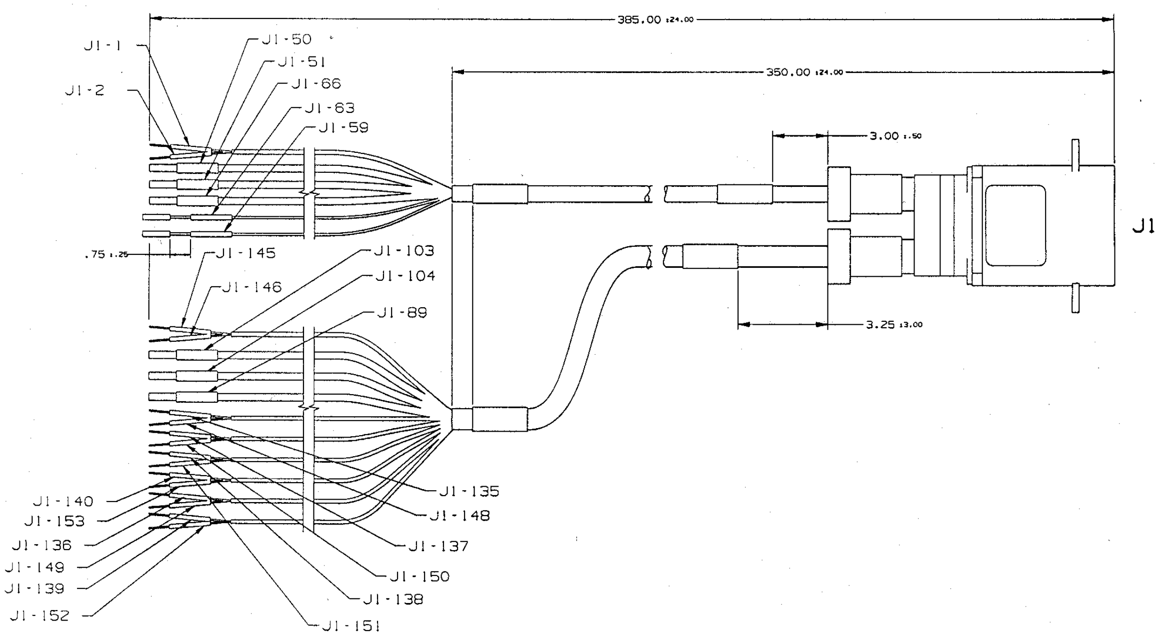



**FIGURE 3.2.1–1 UMA PIN DESIGNATIONS**




NOTE: The numbers following “J1–” in the wire designations in this figure correspond to the pin numbers listed in Table 3.2.1–1.

**FIGURE 3.2.1–2 UMA PASSIVE HALF WIRING TO PAYLOAD**

**TABLE 3.2.1–1 *[ATTACHED PAYLOAD NAME]* CONNECTORS AND PIN ASSIGNMENTS**

| UMA PINOUT DEFINITIONS | | | | | | |
|---|---|---|---|---|---|---|
| ACTIVE | | | | | PASSIVE | |
| CONNECTOR PART NO. NUP1–005 | | | | | CONNECTOR PART NO. NUR1–005 | |
| PIN | SYSTEM | DESCRIPTION | SIGNAL | WIRE* | SIGNAL | DESCRIPTION |
| 1 | C&DH | 1553 BUS A HI | RFH | 22 | | |
| 2 | C&DH | 1553 BUS A LO | RFL | 22 | | |
| 145 | C&DH | 1553 BUS B HI | RFH | 22 | | |
| 146 | C&DH | 1553 BUS B LO | RFL | 22 | | |
| 66 | POWER | PASSTHRU–1 FAULT RTN | GND | 8 | | |
| 50 | POWER | PASSTHRU–1(4B) PWR | PWR | 8 | | |
| 51 | POWER | PASSTHRU–1 (4B) RTN | RTN | 8 | | |
| 89 | POWER | PASSTHRU–2 FAULT RTN | GND | 8 | | |
| 103 | POWER | PASSTHRU–2 (3A) PWR | PWR | 8 | | |
| 104 | POWER | PASSTHRU–2 (3A) RTN | RTN | 8 | | |
| 63 | HRDL | HRDL–IN (Receive from APS) | FO | 16 | | |
| 59 | HRDL | HRDL–OUT (Transmit to APS) | FO | 16 | | |
| 135 | C&DH | PAYLOAD ADDRESS BIT 0 | ML | 22 | | |
| 148 | C&DH | PAYLOAD ADDRESS BIT 0 RTN | ML | 22 | | |
| 136** | C&DH | PAYLOAD ADDRESS BIT 1 | ML | 22 | | |
| 149** | C&DH | PAYLOAD ADDRESS BIT 1 RTN | ML | 22 | | |
| 137 | C&DH | PAYLOAD ADDRESS BIT 2 | ML | 22 | | |
| 150 | C&DH | PAYLOAD ADDRESS BIT 2 RTN | ML | 22 | | |
| 138 | C&DH | PAYLOAD ADDRESS BIT 3 | ML | 22 | | |
| 151 | C&DH | PAYLOAD ADDRESS BIT 3 RTN | ML | 22 | | |
| 139** | C&DH | PAYLOAD ADDRESS BIT 4 | ML | 22 | | |
| 152** | C&DH | PAYLOAD ADDRESS BIT 4 RTN | ML | 22 | | |
| 140 | C&DH | PAYLOAD ADDRESS PAR BIT | ML | 22 | | |
| 153 | C&DH | PAYLOAD ADDRESS PAR BIT RTN | ML | 22 | | |

*For EM classification, wire type, and shield grounding see SSP 30242, Table 3.2.1.1–1.
**Required for PAS addressing only.  No wire exists on UCCAS.

### 3.2.2 ELECTRICAL BONDING

Electrical bonding of the *[Attached Payload Name]* is in accordance with the requirements of SSP 30245, Electrical Bonding Requirements, and NSTS 1700.7 ISS Addendum, Sections 213 and 220. Electrical bonding of the Attached Payload includes providing a Class R electrical bond at the Guide Pin interface with the Guide Vane Assembly at the final berthed position for the fully mated, preloaded and deflected system.

Note: Figure 3.1.2.2–1 illustrates the Guide Pin interface with the GVA and shows the bonding surface on the Guide Pins. Refer to Figure 3.1.2.5–1 that depicts the V–guide well bottoms flattened to facilitate electrical resistance Class R bonding at the bottom of the V–guide interface in accordance with the requirements of SSP 30245.

> Note: The Attached Payload developer must describe the surface treatment for the guide pins to provide at least Class R bonding when the Attached Payload is berthed to the PAS/UCCAS.

### 3.2.3 POWER HANDLING CAPABILITY

Specific Electrical Power System (EPS) characteristics of PAS/UCCAS/MCAS sites are shown in Table 3.2.3–1.

**TABLE 3.2.3–1 EPS CHARACTERISTICS AT ATTACHED PAYLOAD LOCATIONS**

| LOCATION | | MAIN (kW) | MAIN RPC CURRENT RATING (Amps) | AUXILIARY RPC CURRENT RATING (Amps) | RPC TYPE main/aux. |
|---|---|---|---|---|---|
| ITS S3 | PAS–1 | 3 | 25 | 25 | II/II |
| | PAS–2 | 3 | 25 | 25 | II/II |
| | PAS–3 | 3 | 25 | 25 | II/II |
| | PAS–4 | 3 | 25 | 25 | II/II |
| ITS P3 | UCCAS–1 | 3 | 25 | 25 | II/II |
| | UCCAS–2 | 3 | 25 | 25 | II/II |
| | MCAS | 1.35 | 12 | 12 | I/I |

### 3.2.4 IMPEDANCE LIMITS

#### 3.2.4.1 SOURCE IMPEDANCE LIMITS

The source impedance at Attached Payload Power Interface (APPI) locations meets the limits as shown in Figure 3.2.4.1–1 and Figure 3.2.4.1–2. The source impedance at MCAS power interface locations meets the limits as shown in Figure 3.2.4.1–3 and Figure 3.2.4.1–4.

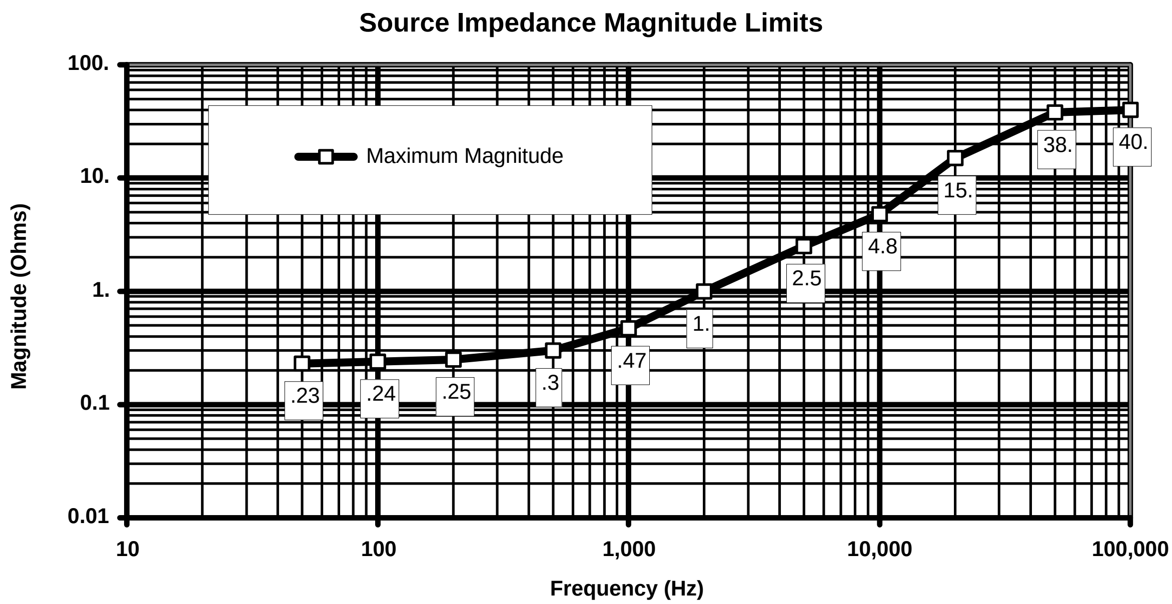



**FIGURE 3.2.4.1–1 APPI SOURCE IMPEDANCE MAGNITUDE LIMITS**

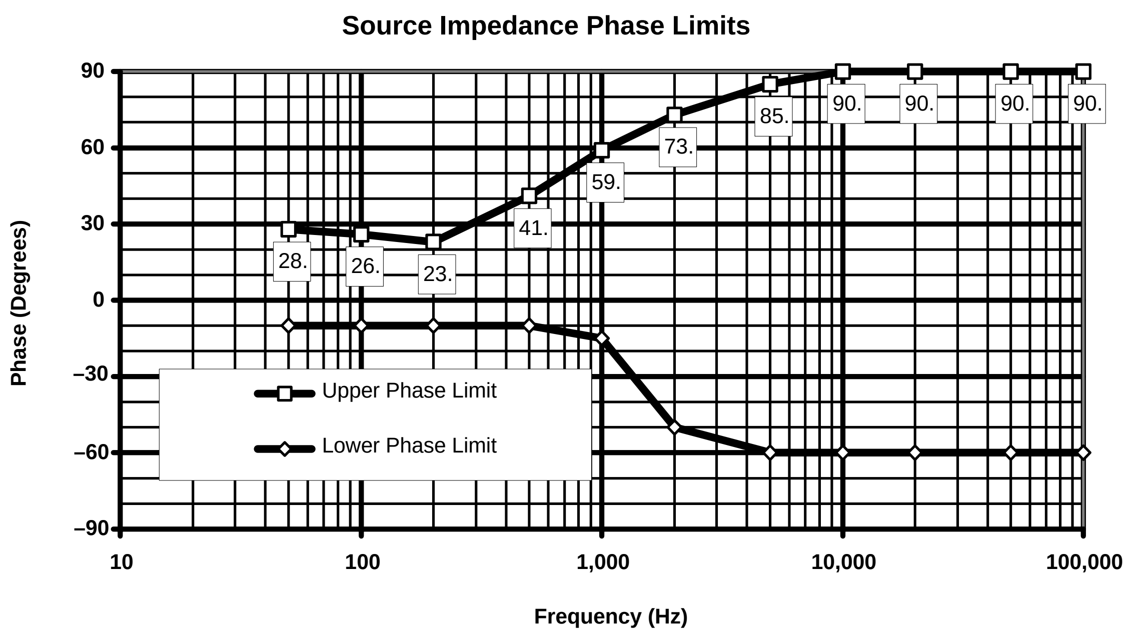
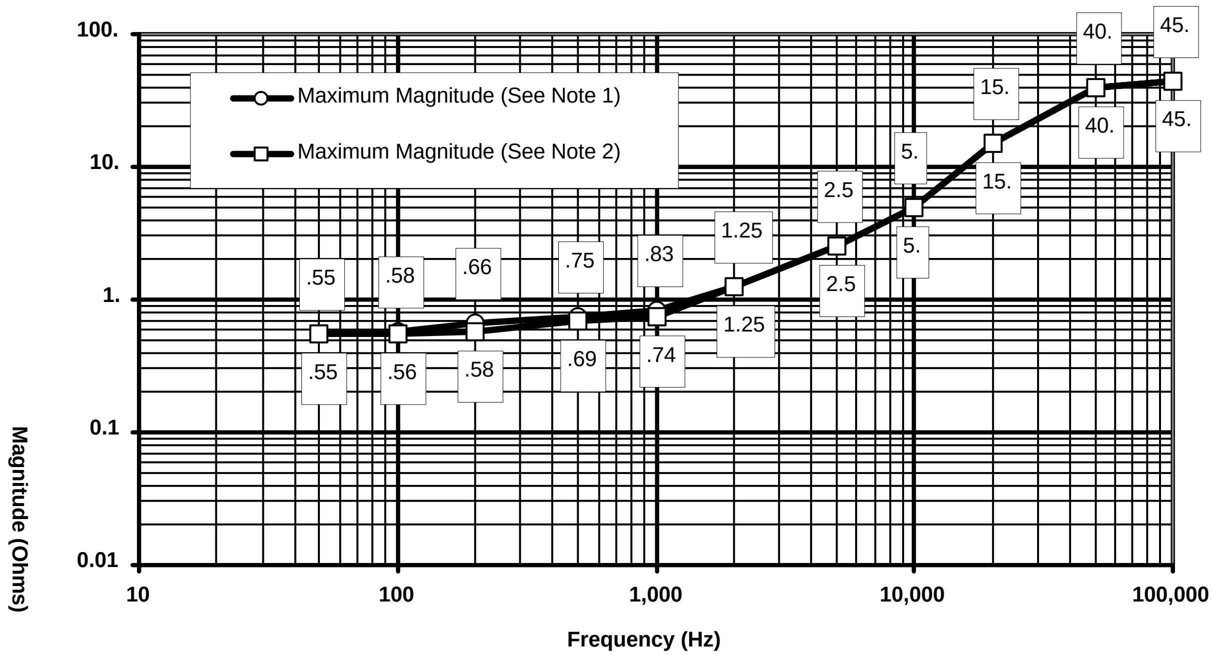



**FIGURE 3.2.4.1–2 APPI SOURCE IMPEDANCE PHASE LIMITS**

**Source Impedance Magnitude Limits**

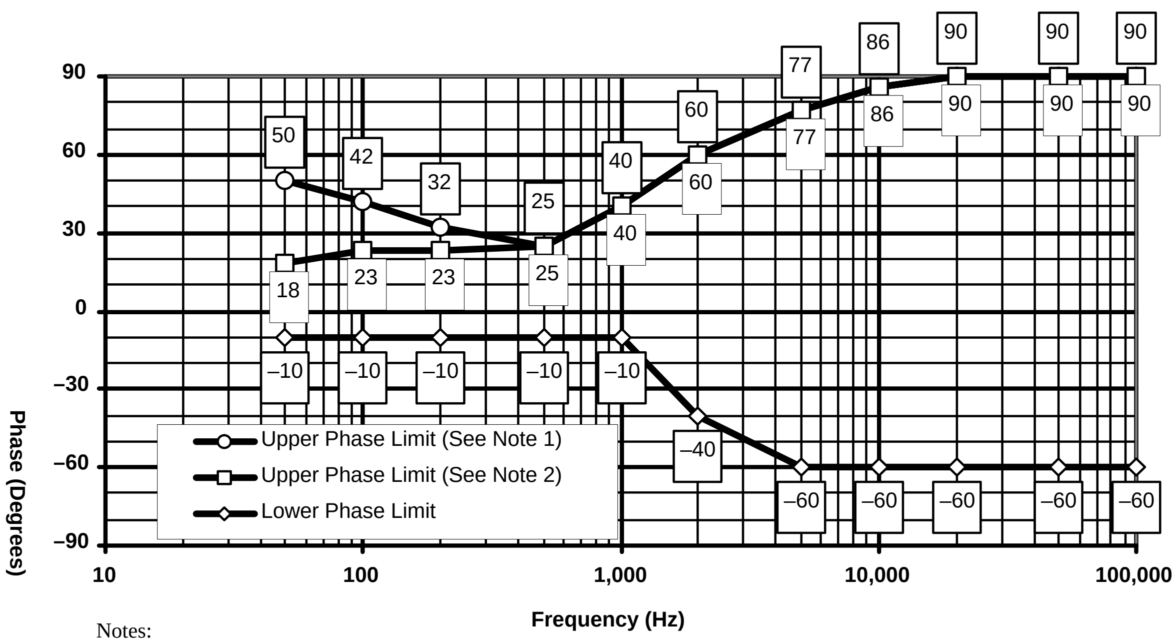



Notes:

1. Limits when steady state DDCU loading is less than 400 watts.
2. Limit when steady state DDCU loading is at least 400 watts.

**FIGURE 3.2.4.1–3 MCAS SOURCE IMPEDANCE MAGNITUDE LIMITS**

**Source Impedance Phase Limits**




Notes:

1. Limits when steady state DDCU loading is less than 400 watts.
2. Limit when steady state DDCU loading is at least 400 watts.

**FIGURE 3.2.4.1–4 MCAS SOURCE IMPEDANCE MAGNITUDE LIMITS**

### 3.2.4.2 LOAD IMPEDANCE LIMITS

The *[Attached Payload Name]* load impedance magnitude and phase values at the APPI are shown in Figure 3.2.4.2–1 and Figure 3.2.4.2–2.

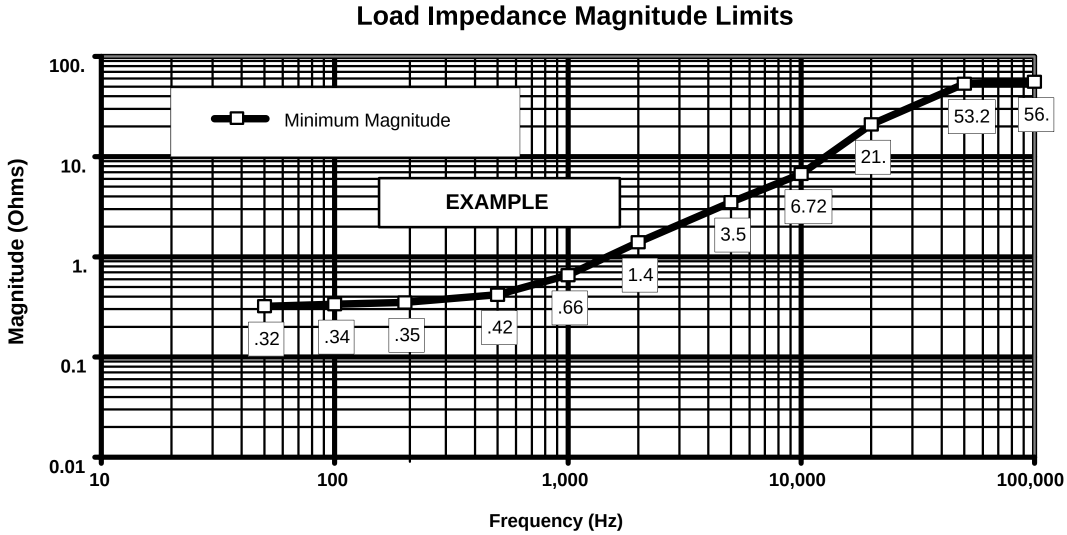



**FIGURE 3.2.4.2–1 *[ATTACHED PAYLOAD NAME]* APPI LOAD IMPEDANCE MAGNITUDE**

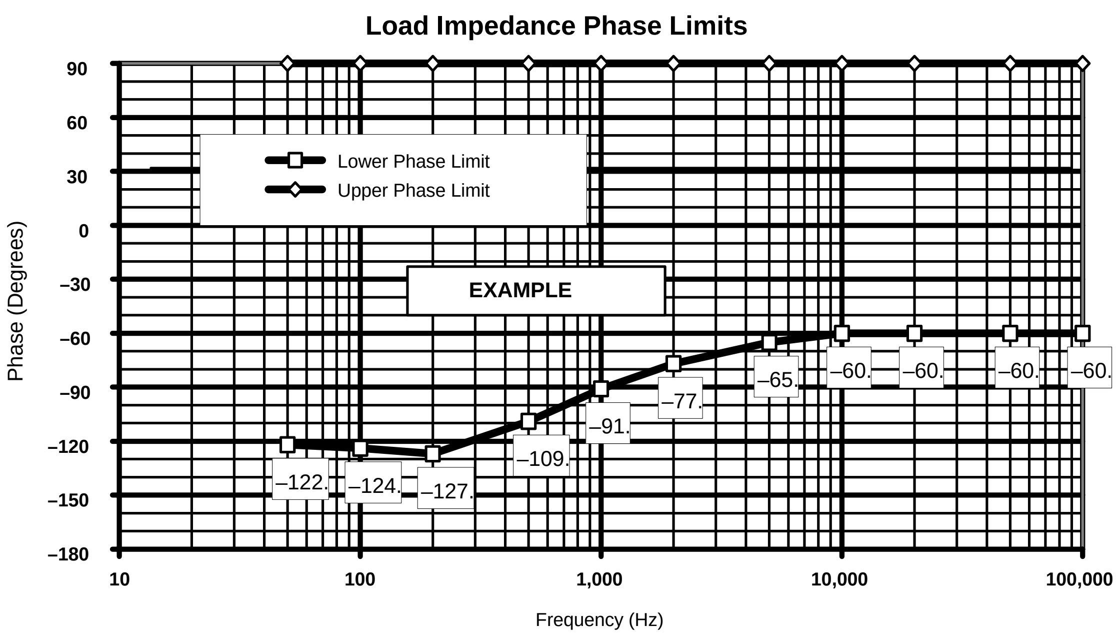



**FIGURE 3.2.4.2–2 [*ATTACHED PAYLOAD NAME]* APPI LOAD IMPEDANCE PHASE**

> Note: The Attached Payload developer will provide the Attached Payload measured load impedance magnitude and phase data for the Attached Payload impedance magnitude and phase limit graphs in Figures 3.2.4.2–1 and 3.2.4.2–2. The format will be similar to the examples shown.

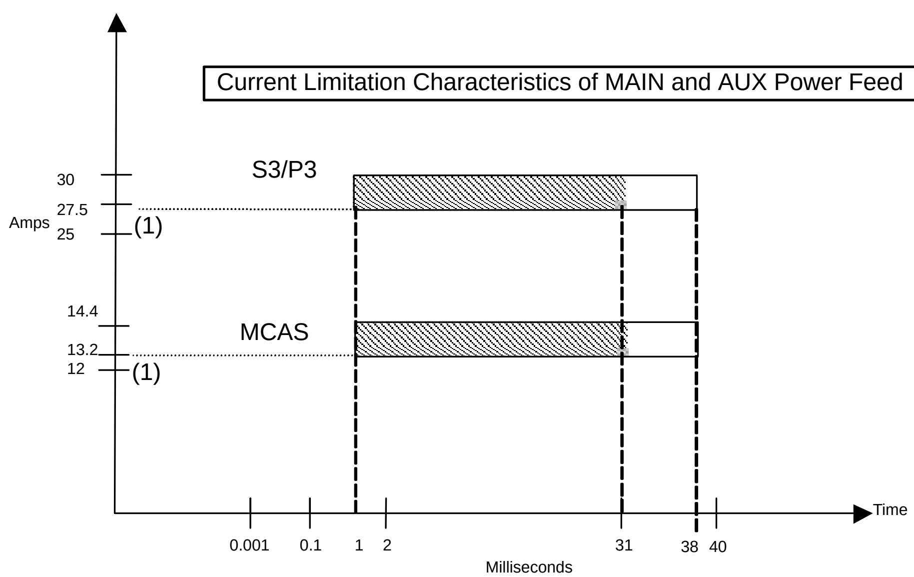
### 3.2.5 REMOTE POWER CONTROLLER OVERLOAD LIMIT

The ISS power source will provide protection to the APPI for overload conditions by means of a remote power controller. The overload limitation characteristics of the power feeds are defined in Table 3.2.5–1 and Figure 3.2.5–1. Current limiting protection devices start to limit the current when the current reaches the limiting threshold. The shaded regions in the figures show the current limit regions from the time the protection devices start to control the current within the specified range to the maximum time where the protection device trips and interrupts the current flow. Nominal current ratings are 25 amperes. The current at the S3/P3 APPI will be controlled to within the limiting level of 27.5 to 30 amperes within 1 millisecond. The current at the MCAS power interface will be controlled to within the limiting level of 13.2 to 14.4 amperes within 1 millisecond. The Remote Power Controller (RPC) will trip if the current remains in the limiting region up to the decision time of 34.5 ± 3.5 milliseconds.

**TABLE 3.2.5–1 DETAILED UPSTREAM PROTECTION CHARACTERISTICS**

| POWER INTERFACE | MAIN PWR FEED | | | AUX PWR FEED | |
|---|---|---|---|---|---|
| | LOWEST CURRENT LIMITATION LEVEL | MINIMUM TRIP THRESHOLD | MINIMUM* TRIP DECISION TIME | LOWEST CURRENT LIMITATION LEVEL | MINIMUM* TRIP DECISION TIME |
| S3 PAS | 27.5A | 27.5A | 31ms | 27.5A | 31ms |
| P3 UCCAS | 27.5A | 27.5A | 31ms | 27.5A | 31ms |
| MCAS | 13.2A | 13.2A | 31ms | 13.2A | 31ms |

*Trip decision time at or above limiting/trip threshold (27.5A to 30.0A at S3 and P3 APPI and 13.2A to 14.4A at MCAS power interface).




Note (1) During the first 1 millisecond the limiting level may be higher or lower than specified.

**FIGURE 3.2.5–1 ITS S3 OVERLOAD PROTECTION CHARACTERISTICS**

> Note: The Attached Payload developer will provide the overload protection characteristics curve for the Attached Payload in Figure 3.2.5–2 using the same format as Figure 3.2.5–1 for up to 50 milliseconds.

**FIGURE 3.2.5–2 OVERLOAD PROTECTION CHARACTERISTICS OF THE *[ATTACHED PAYLOAD NAME]* DOWNSTREAM CIRCUITS**

### 3.2.6 ELECTRICAL POWER CONSUMING EQUIPMENT (EPCE) INTERFACE WITH THE APPI

The *[Attached Payload Name]* power consumption and current draw is defined in Table 3.2.6–1. The *[Attached Payload Name]* surge current is illustrated in Figure 3.2.6–1 and the electrical schematic is provided in Figure 3.2.6–2.

> Note: The Attached Payload developer will record payload characteristics in Table 3.2.6–1 for each mode of operation.

**TABLE 3.2.6–1 ATTACHED PAYLOAD POWER CONSUMPTION**

| | POWER (WATTS) MAIN FEED | | | POWER (WATTS) AUXILIARY FEED | | |
|---|---|---|---|---|---|---|
| On–Orbit Interfaces | Peak | Max Cont | Keep Alive | Peak | Max Cont | Keep Alive |
| SRMS | | | | | | |
| SSRMS | | | | | | |
| MCAS | | | | | | |
| S3 PAS | | | | | | |
| P3 UCCAS | | | | | | |

Note:
1. Peak power is defined as the highest power requirement lasting greater than 50 milliseconds.
2. Max Continuous power is defined as the steady state power condition.
3. Keep Alive power is defined as the lowest uninterrupted power requirement for the Attached Payload to avoid payload failure or damage.

Note: The Attached Payload developer will replace the example in Figure 3.2.6–1 with a similar graph that displays the Attached Payload worst case surge current values as a function of time without the current limiting capability of the ISS power source circuit protection.

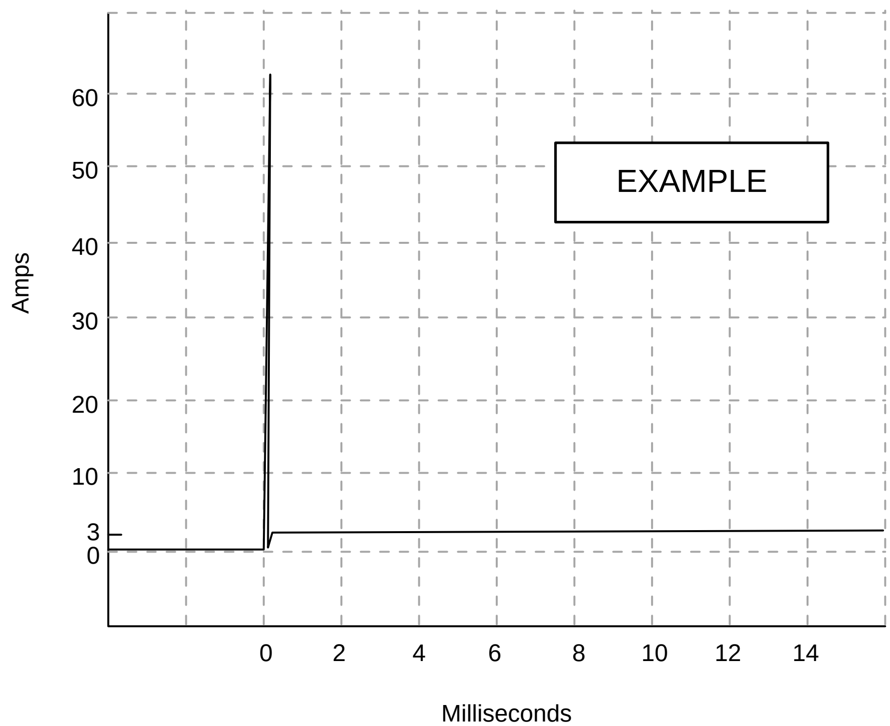



**FIGURE 3.2.6–1 ATTACHED PAYLOAD SURGE CURRENT**

Note: The Attached Payload developer will replace the example detailed electrical schematic in Figure 3.2.6–2 with a detailed schematic of the Attached Payload that includes, but is not limited to, wire gauge, circuit protection devices, and isolation resistance between main and auxiliary fields, electrical grounding schemes, etc. The format will be similar to the example shown. Filter schematics are to be supplied including component values.

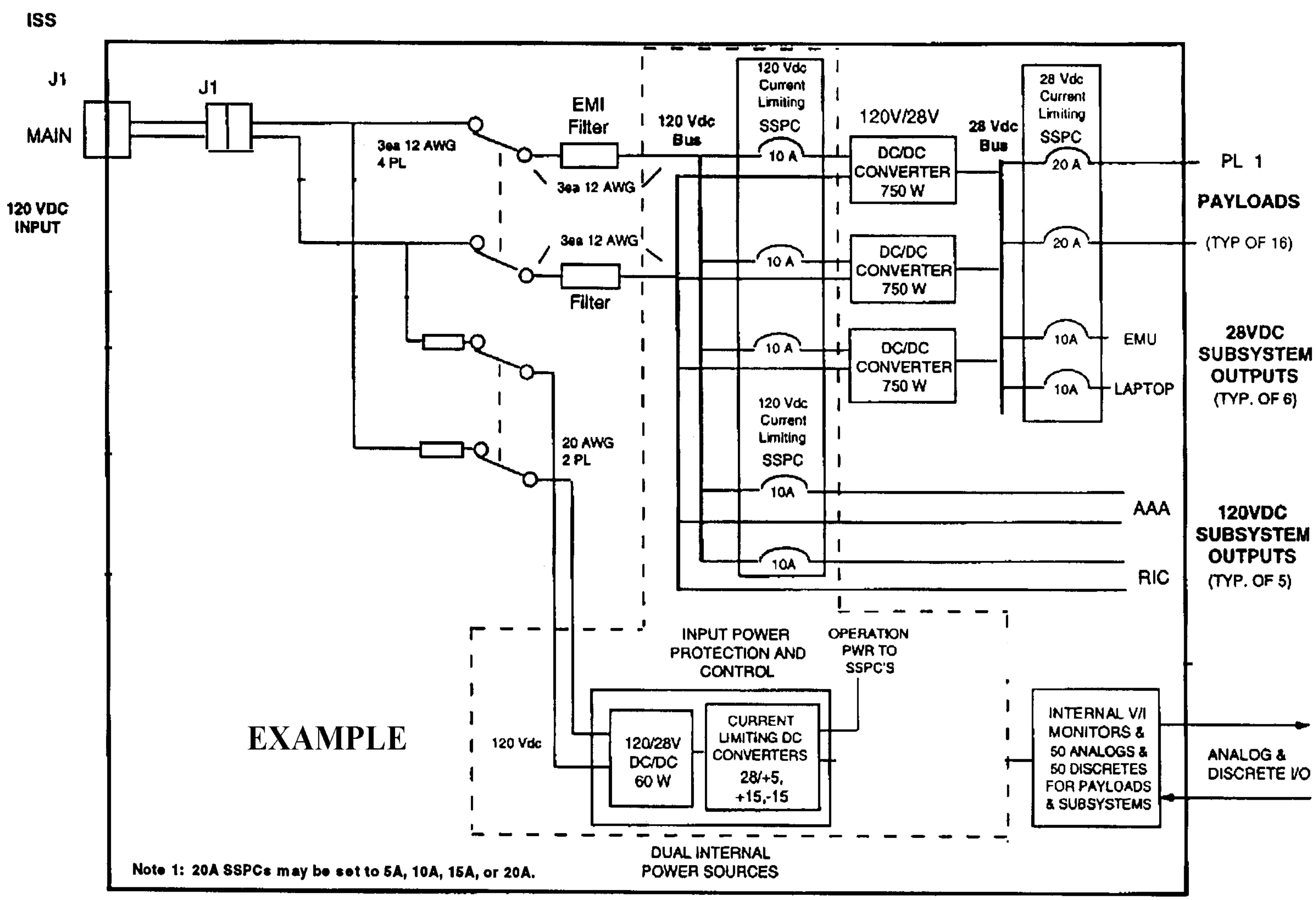



**FIGURE 3.2.6–2 ELECTRICAL SCHEMATIC OF THE ATTACHED PAYLOAD INTERFACE TO THE APPI**

## 3.3 COMMAND AND DATA HANDLING INTERFACES

Each PAS site provides connections to the ISS MIL–STD–1553, Digital Time Division Command/Response Multiplex Data Bus, and High Rate Data Link (HRDL) systems through the UMA. The *[Attached Payload Name]* receives command and control signals via the active UMA. Each UMA has a single redundant MIL–STD–1553 data bus (two channels where only one channel is active at a time), and two HRDL fiber optic channels (transmit and receive).

### 3.3.1 MIL–STD–1553 LOW RATE DATA LINK

PAS/UCCAS provides a MIL–STD–1553 transmit and receive data interface at the UMA interface to support low rate telemetry, and health and status data communications for Attached Payloads. The Attached Payload represents a single Remote Terminal (RT) to the ISS MIL–STD–1553 Bus.

#### 3.3.1.1 MIL–STD–1553 LRDL CONNECTOR/PIN ASSIGNMENTS

The *[Attached Payload Name]* interfacing with MIL–STD–1553 Bus to transmit data and/or receive commands utilizes the connector and pin assignments for the UMA in accordance with Table 3.2.1–1.

> Note: The Attached Payload developer must record connector part number and the Low Rate Data Link (LRDL) pin assignments for the passive UMA in Table 3.2.1–1.

#### 3.3.1.2 LRDL CABLING

The *[Attached Payload Name]* MIL–STD–1553 internal wiring characteristics are in accordance with SSQ 21655, Cable, Electrical, MIL–STD–1553 Data Bus, Space Quality, General Specification Document for 75 Ohm or equivalent. The *[Attached Payload Name]* MIL–STD–1553 internal wiring characteristics are summarized in Table 3.3.1.2–1.

> Note: The Attached Payload developer will record the MIL–STD–1553 cable characteristics including impedance, wire size, capacitance, and stub length for the Attached Payload in Table 3.3.1.2–1. The wire size is measured in American Wire Gauge (AWG) and the capacitance is measured in pico farads per meter (pf/m). The stub length is measured from the active UMA connector to the Attached Payload MIL–STD–1553 Remote Terminal.

**TABLE 3.3.1.2–1 MIL–STD–1553 CABLE CHARACTERISTICS**

| Type | Recommended Payload Twisted Shielded Pair | Attached Payload Twisted Shielded Pair |
|---|---|---|
| Characteristic Impedance | 75 ± 5 Ohm | |
| Wire Size | 22 AWG or 24 AWG | |
| Nominal Wire to Wire Capacitance | 66 pf/m | |
| Internal Wiring Stub Length | ≤ 10 feet | |

### 3.3.2 HIGH RATE DATA LINK

PAS/UCCAS provides two HRDL channels, one for transmitting data and one for receiving data at each PAS UMA interface to support high rate data communications to and from the Attached Payload.

#### 3.3.2.1 HRDL CONNECTOR/PIN ASSIGNMENTS

The *[Attached Payload Name]* interfacing with the HRDL utilizes the same passive UMA connector, NUR1–005, as defined in SSQ 21637. The active and passive UMA connectors and pin assignments are shown in Table 3.2.1–1.

> Note: The Attached Payload developer must record connector part number(s), HRDL data pin assignments for the passive UMA in Table 3.2.1–1.

#### 3.3.2.2 HRDL CABLING

The *[Attached Payload Name]* HRDL fiber optic cable characteristics are in accordance with SSQ 21654, Cable Single Fiber, Multitude, Space Quality General Specification Characteristics. HRDL input and output characteristics are in accordance with SSP 50184 Appendix C, High Rate Data Link Physical Media, Physical Signaling and Protocol Specifications.

> Note: The Attached Payload developer must provide the measured optical power loss in both receive and transmit modes measured at the UMA connector.

## 3.4 PASSIVE THERMAL CONTROL INTERFACES

The ITS S3/P3 passive thermal control interfaces are based on thermal analysis using The Boeing Company generated thermal math model provided to NASA in D684–10058–03–01, ISS Thermal Math Model, Volume 3, Book 1. The Attached Payload passive thermal control design will be analyzed using the S3 thermal math model in D684–10058–03–01.

### 3.4.1 ITS S3 PAS/P3 UCCAS THERMAL INTERFACES

*[Attached Payload Name]* to the PAS/UCCAS interfaces meet all specified requirements when the structural interface temperature is within –120°F and + 200°F. The structural interface temperatures between the Attached Payload and the PAS are shown in Table 3.4.1–1.

> Note: The Attached Payload developer will record the maximum and minimum interface temperatures between the Attached Payload and the PAS/UCCAS in Table 3.4.1–1.

**TABLE 3.4.1–1 *[ATTACHED PAYLOAD NAME]* AND PAS/UCCAS INTERFACE TEMPERATURES**

| Attached Payload PAS/UCCAS | Cold | Hot |
|---|---|---|
| | | |

### 3.4.2 DELETED

### 3.4.3 EXTERNAL SURFACE OPTICAL PROPERTIES

The *[Attached Payload Name]* external optical surface properties are shown in Figure 3.4.3–1 and are contained in Table 3.4.3–1.

> Note: The Attached Payload developer will provide a drawing to show the mapping of the Attached Payload representative surface optical nodes in Figure 3.4.3–1.

**FIGURE 3.4.3–1 *[ATTACHED PAYLOAD NAME]* EXTERNAL SURFACE OPTICAL PROPERTIES**

> Note: The Attached Payload developer will record external optical surface properties (absorptivity and emissivity) for all significant surfaces on all faces of the Attached Payload in Table 3.4.3–1.

**TABLE 3.4.3–1 *[ATTACHED PAYLOAD NAME]* EXTERNAL SURFACE OPTICAL PROPERTIES**

| Node | Absorptivity ($\alpha$) BOL | Emissivity ($\varepsilon$) BOL | Absorptivity ($\alpha$) EOL | Emissivity ($\varepsilon$) EOL |
|---|---|---|---|---|
| | | | | |
| | | | | |
| | | | | |

Key: BOL = Beginning of Life
EOL = End of Life

## 3.5 EXTRAVEHICULAR ROBOTICS INTERFACES

### 3.5.1 GRAPPLE FIXTURE LOCATIONS

The *[Attached Payload Name]* grapple fixtures are located in accordance with Figure 3.5.1–1.

> Note: The Attached Payload developer will provide a drawing to show the Attached Payload grapple fixture locations in Figure 3.5.1–1.

**FIGURE 3.5.1–1 *[ATTACHED PAYLOAD NAME]* GRAPPLE FIXTURE LOCATIONS**

### 3.5.2 SPECIAL DEXTEROUS GRASP FIXTURE LOCATIONS

The *[Attached Payload Name]* Special Dexterous Grasp Fixture(s) (SDGF) are located in accordance with Figure 3.5.2–1.

> Note: The Attached Payload developer will provide a drawing showing the locations of SDGFs on the Attached Payload in Figure 3.5.2–1.

**FIGURE 3.5.2–1 *[ATTACHED PAYLOAD NAME]* SDGF LOCATIONS**

## 3.6 EXTRAVEHICULAR ACTIVITY INTERFACES

The Attached Payload is designed such that all operations are performed via Extravehicular Robotics (EVR), with contingency EVA capability. While EVR is primary for Attached Payloads, the Attached Payload developer will provide the hardware, translation paths, and appropriate labeling to affect EVA access to the Attached Payload hardware in accordance with SSP 50005 and SSP 30256.

### 3.6.1 EVA AIDS LOCATIONS

EVA aids for *[Attached Payload Name]* contingency operations are shown in Figure 3.6.1–1.

> Note: The Attached Payload developer will provide a drawing showing the locations of EVA aids (i.e. handrails, tether attachment points, etc.) for Attached Payloads contingency operations in Figure 3.6.1–1.

**FIGURE 3.6.1–1 *[ATTACHED PAYLOAD NAME]* EVA AIDS LOCATIONS**

### 3.6.2 EVA TRANSLATION PATHS

The *[Attached Payload Name]* EVA translation paths with gaps ≤ 24 inches are shown to connect to existing ISS translation paths in Figure 3.6.2–1.

> Note: The Attached Payload developer will provide a drawing showing the EVA translation paths for the Attached Payload in Figure 3.6.2–1. At least one of the Attached Payload handrails must be within 24 inches of the ISS provided handrails.

**FIGURE 3.6.2–1 *[ATTACHED PAYLOAD NAME]* EVA TRANSLATION PATHS**

### 3.6.3 DANGER AND WARNING LOCATIONS

The *[Attached Payload Name]* translation and mobility handholds located within three ft. of the Attached Payload equipment which poses a critical or catastrophic hazard to the crewmember or to the equipment are identified as shown in Figure 3.6.3–1.

> Note: The Attached Payload developer will provide a drawing to show the Attached Payload danger and warning locations in Figure 3.6.3–1.

**FIGURE 3.6.3–1 *[ATTACHED PAYLOAD NAME]* DANGER AND WARNING LOCATIONS**

## 3.7 EBCS INTERFACES

### 3.7.1 EBCS AVIONICS PACKAGE MECHANICAL INTERFACE

The Avionics package mounting interface, dimensions and locking insert type are shown in Figure 3.7.1–1.

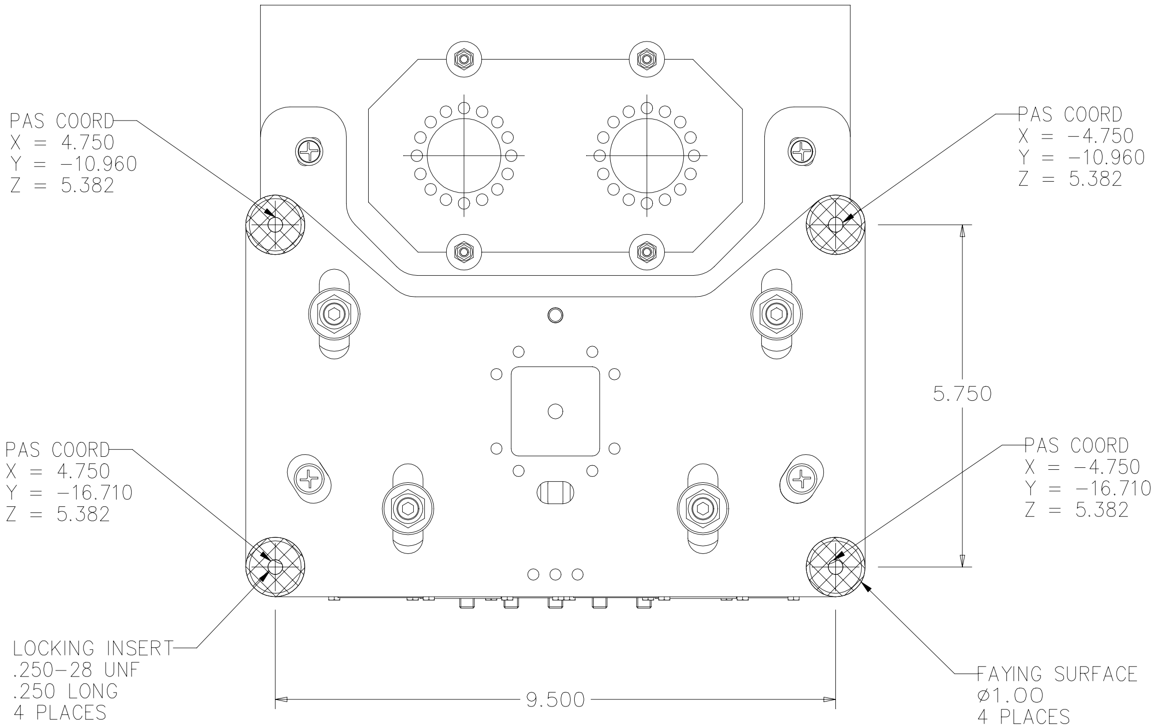
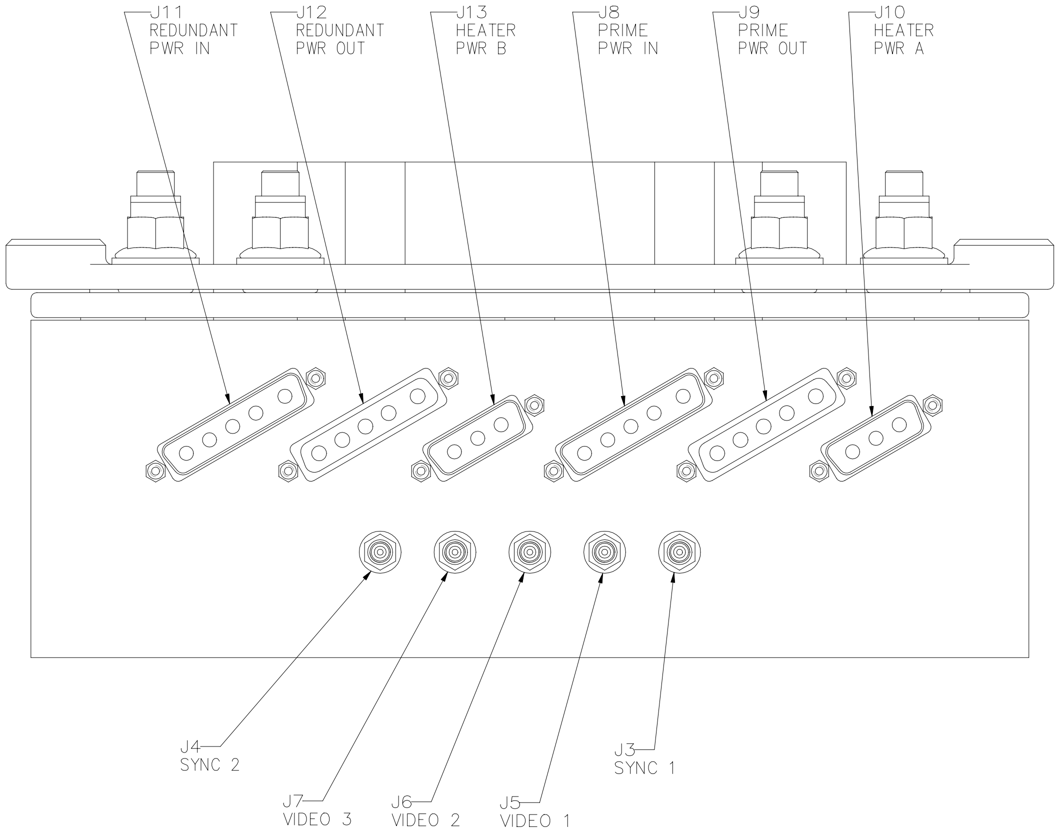



**TABLE 3.7.1–1 EBCS AVIONICS PACKAGE MOUNTING INTERFACE DIMENSIONS**

### 3.7.2 EBCS CONNECTOR INTERFACES

Figure 3.7.2–1 illustrates the primary power channel A, redundant power channel B, heater power A, heater power B, payload power A, payload power B, video 1, video 2, video 3, sync 1 and sync 2 connector locations on the avionics package chassis with respect to the PAS coodinate system. Figure 3.7.2–2 is a functional block diagram of the EBCS.




| DESIG | DESCRIPTION | X CORD | Y CORD | Z CORD |
|---|---|---|---|---|
| J11 | Redundant Power In | –2.948 | –17.070 | –5.965 |
| J12 | Redundant Power Out | –1.618 | –17.070 | –5.965 |
| J13 | Heater Power B | –0.664 | –17.070 | –6.182 |
| J8 | Prime Power In | 1.042 | –17.070 | –5.965 |
| J9 | Prime Power Out | 2.372 | –17.070 | –5.965 |
| J10 | Heater Power A | 3.326 | –17.070 | –6.182 |
| J4 | Sync 2 | –1.500 | –17.070 | –7.225 |
| J7 | Video 3 | –0.750 | –17.070 | –7.225 |
| J6 | Video 2 | 0.000 | –17.070 | –7.225 |
| J5 | Video 1 | 0.750 | –17.070 | –7.225 |
| J3 | Sync 1 | 1.500 | –17.070 | –7.225 |

**FIGURE 3.7.2–1 EBCS AVIONICS PACKAGE CONNECTOR LOCATIONS**

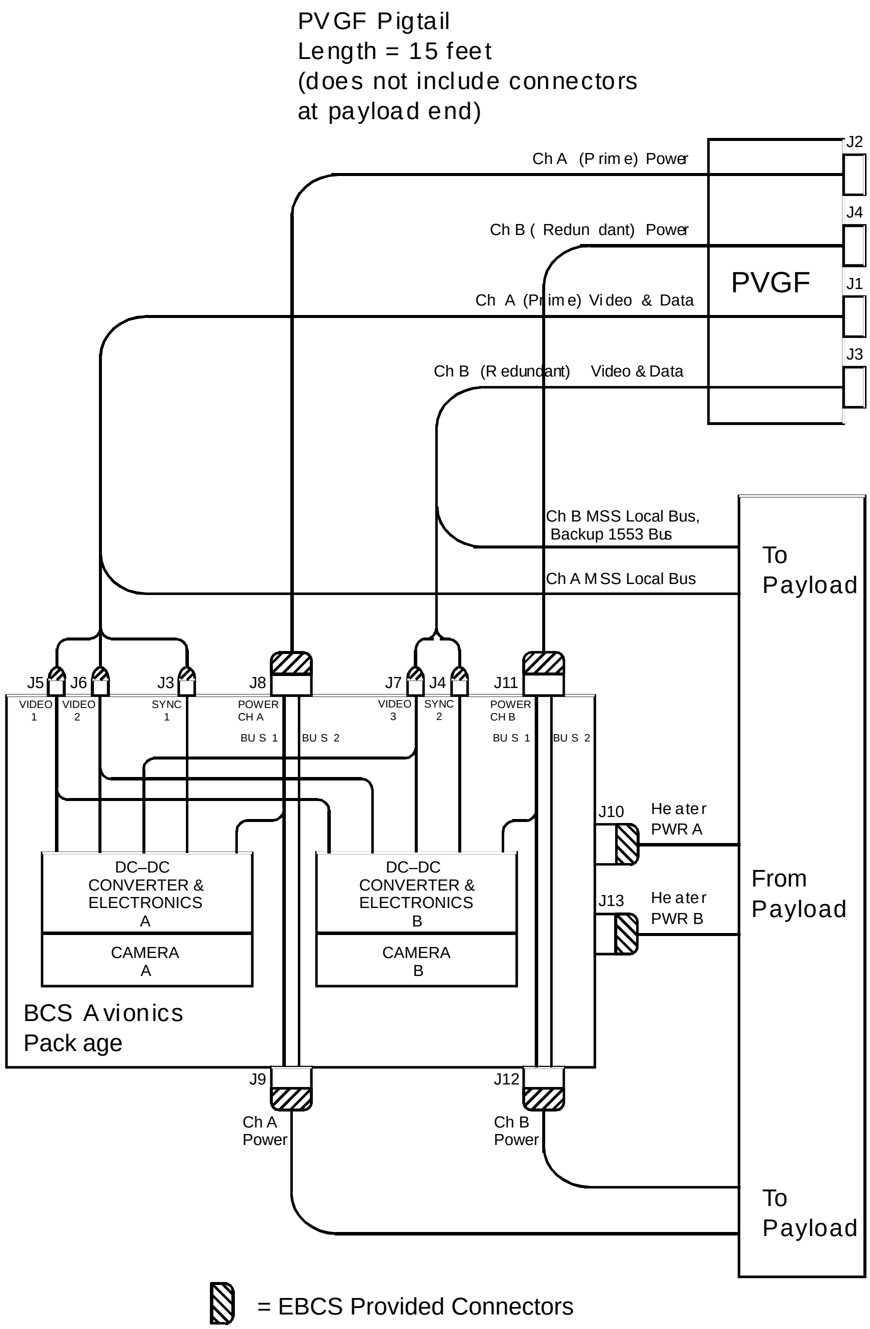



**FIGURE 3.7.2–2 EBCS FUNCTIONAL BLOCK DIAGRAM**

Table 3.7.2–1 lists the connector designation and part number, the mating connector part numbers and connector pin outs for primary power channel A, redundant power channel B, heater power A, heater power B, payload power A and payload power B. The table also lists voltage, impedance and connector pin outs for video 1, video 2, video 3, sync 1 and sync 2.

# TABLE 3.7.2–1 EBCS CONNECTOR SPECIFICATIONS

| Designation | Nomenclature | Part Number | Pin P/N | Signal Level | Impedance | Mating Connector P/N | Socket P/N | Backshell |
|---|---|---|---|---|---|---|---|---|
| J1 | Test Port – Not Accessible | | | | | | | |
| J2 | Test Port – Not Accessible | | | | | | | |
| J3 | Modulated Video IN Prime | 142–0701–501* | Center | 2V p–p | 50 | AMP P/N 225609–4 | Center | |
| J4 | Modulated Video IN Back–up | 142–0701–501* | Center | 2V p–p | 50 | AMP P/N 225609–4 | Center | |
| J5 | PFM output 1 | 142–0701–501* | Center | 2V p–p | 50 | AMP P/N 225609–4 | Center | |
| J6 | PFM output 2 | 142–0701–501* | Center | 2V p–p | 50 | AMP P/N 225609–4 | Center | |
| J7 | PFM output 3 | 142–0701–501* | Center | 2V p–p | 50 | AMP P/N 225609–4 | Center | |
| J8–1 | Prime Payload Power Bus 1 | AMP 212491–6 | 449379–1 | +120 VDC | | AMP P/N 215059–2 | 212008–1 | 203345–1** |
| J8–2 | Prime Payload Power Bus 1 RTN | | 449379–1 | 120 VDC RTN | | | 212008–1 | |
| J8–3 | SSRMS GND | | 449379–1 | GND | | | 212008–1 | |
| J8–4 | Prime Payload Power Bus 2 | | 449379–1 | +120 VDC | | | 212008–1 | |
| J8–5 | Prime Payload Power Bus 2 RTN | | 449379–1 | 120 VDC RTN | | | 212008–1 | |
| J9–1 | Prime Payload Power Bus 1 | AMP 212059–2 | 445798–1 | +120 VDC | | AMP P/N 212491–6 | 212007–1 | 203345–1** |
| J9–2 | Prime Payload Power Bus 1 RTN | | 445798–1 | 120 VDC RTN | | | 212007–1 | |
| J9–3 | SSRMS GND | | 445798–1 | GND | | | 212007–1 | |
| J9–4 | Prime Payload Power Bus 2 | | 445798–1 | +120 VDC | | | 212007–1 | |
| J9–5 | Prime Payload Power Bus 2 RTN | | 445798–1 | 120 VDC RTN | | | 212007–1 | |
| J10–1 | Prime 120 V Heater Power | AMP 207252–2 | 1–212565–0 | +120 VDC | | AMP P/N 207253–2 | 206793–1 | 203344–1** |
| J10–2 | Prime 120 V Heater Power RTN | | 1–212565–0 | 120 VDC RTN | | | 206793–1 | |
| J10–3 | No Contact | | 1–212565–0 | | | | 206793–1 | |
| J10–4 | No Contact | | 1–212565–0 | | | | 206793–1 | |
| J10–5 | No Contact | | 1–212565–0 | | | | 206793–1 | |
| J10–6 | No Contact | | 1–212565–0 | | | | 206793–1 | |
| J10–7 | No Contact | | 1–212565–0 | | | | 206793–1 | |
| J10–8 | No Contact | | 1–212565–0 | | | | 206793–1 | |
| J10–9 | Prime Chassis GND | | 1–212565–0 | Chassis GND | | | 206793–1 | |
| J11–1 | Back–up Payload Power Bus 1 | AMP 212491–6 | 449379–1 | +120 VDC | | AMP P/N 212059–2 | 212008–1 | 203345–1** |
| J11–2 | Back–up Payload Power Bus 1 RTN | | 449379–1 | 120 VDC RTN | | | 212008–1 | |
| J11–3 | SSRMS GND | | 449379–1 | GND | | | 212008–1 | |
| J11–4 | Back–up Payload Power Bus 2 | | 449379–1 | +120 VDC | | | 212008–1 | |
| J11–5 | Back–up Payload Power Bus 2 RTN | | 449379–1 | 120 VDC RTN | | | 212008–1 | |
| J12–1 | Back–up Payload Power Bus 1 | AMP 212059–2 | 445798–1 | +120 VDC | | AMP P/N 212491–6 | 212007–1 | 203345–1** |
| J12–2 | Back–up Payload Power Bus 1 RTN | | 445798–1 | 120 VDC RTN | | | 212007–1 | |
| J12–3 | SSRMS GND | | 445798–1 | GND | | | 212007–1 | |
| J12–4 | Back–up Payload Power Bus 2 | | 445798–1 | +120 VDC | | | 212007–1 | |
| J12–5 | Back–up Payload Power Bus 2 RTN | | 445798–1 | 120 VDC RTN | | | 212007–1 | |
| J13–1 | Back–up 120 V Heater Power | AMP 207252–2 | 1–212565–0 | +120 VDC | | AMP P/N 207253–2 | 206793–1 | 203344–1** |
| J13–2 | Back–up 120 V Heater Power RTN | | 1–212565–0 | 120 VDC RTN | | | 206793–1 | |
| J13–3 | No Contact | | 1–212565–0 | | | | 206793–1 | |
| J13–4 | No Contact | | 1–212565–0 | | | | 206793–1 | |
| J13–5 | No Contact | | 1–212565–0 | | | | 206793–1 | |
| J13–6 | No Contact | | 1–212565–0 | | | | 206793–1 | |
| J13–7 | No Contact | | 1–212565–0 | | | | 206793–1 | |
| J13–8 | No Contact | | 1–212565–0 | | | | 206793–1 | |
| J13–9 | Back–up Chassis GND | | 1–212565–0 | Chassis GND | | | 206793–1 | |

*Johnson Components
**Positronics, modified by MDR

# 4.0 APPLICABILITY MATRIX

## 4.1 PURPOSE

The purpose of this Attached Payload Unique Interface Control Document (ICD) is to define and control the design of interfaces between the ISS and the [*Attached Payload Name]*. The Attached Payload interfaces are defined by direct reference to the corresponding sections and subsections of SSP 57003, Attached Payload Interface Requirements Document (IRD). The Attached Payload developer and the ISS Payloads Office must mutually disposition each IRD paragraph and record that disposition in an applicability matrix contained in the unique payload ICD. The documented applicability matrix for the unique payload serves as the basis for developing the unique Attached Payload verification plan according to SSP 57013, Generic Attached Payload Verification Plan.

## 4.2 ORGANIZATION

In Table 4.2–1, Applicability Matrix, the numbers and headings are directly referenced to the sections and subsections of the IRD. The entries in Table 4.2–1, which are shaded, are titles that are included for reference only and are not required to be dispositioned. Each paragraph of the IRD shall be dispositioned with one of the following:

Each paragraph of the IRD shall be dispositioned in the “PAYLOAD APPLICABILITY” column with one of the following:

A — Applicable to this ICD, indicating that the referenced IRD interface requirement.

N/A — Not Applicable to this ICD, indicating that the referenced interface is not applicable to the ITS S3/P3 or the Attached Payload hardware item.

E-## — Exception with the exception identifier (reference) number ## as listed in the ”Exceptions” table. The ITS S3/P3 or payload hardware item must meet the requirements as specified by this exception in Appendix C of this ICD.

.

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 1 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.0 | INTERFACE REQUIREMENTS | |
| 3.1 | STRUCTURAL/MECHANICAL AND MICROGRAVITY INTERFACE REQUIREMENTS | |
| 3.1.1 | GENERAL DESIGN REQUIREMENTS | |
| 3.1.1.1 | SAFETY CRITICAL STRUCTURES | |
| 3.1.1.1.1 | FAIL–SAFE, SAFE–LIFE, OR LOW–RISK FRACTURE PARTS | |
| 3.1.1.1.2 | FRACTURE CONTROL | |
| 3.1.1.1.3 | METEOROID AND ORBITAL DEBRIS PROTECTION REQUIREMENT FOR EXTERNAL PAYLOADS | |
| 3.1.1.2 | INTERFACE LOADS | |
| 3.1.1.2.1 | MARGINS OF SAFETY | |
| 3.1.1.2.2 | FACTOR(S) OF SAFETY | |
| 3.1.1.2.3A | DESIGN LOADS – PAYLOAD DESIGN | |
| 3.1.1.2.3B | DESIGN LOADS – PAYLOAD INDUCED | |
| 3.1.1.2.4 | PAYLOAD BERTHING | |
| 3.1.1.2.4.1 | GUIDE PIN CONTACT FORCES | |
| 3.1.1.2.4.2 | CAPTURE BAR CONTACT FORCES | |
| 3.1.1.2.5 | THERMAL EFFECTS | |
| 3.1.1.2.6 | EXTRAVEHICULAR ACTIVITY ON–ORBIT INDUCED LOADS | |
| 3.1.1.3 | DESIGN SERVICE LIFE | |
| 3.1.1.4 | OPERATIONAL LIFETIME | |
| 3.1.1.5 | INTERCHANGEABILITY | |
| 3.1.1.6 | ATTACHED PAYLOAD INTERFACE DURABILITY | |
| 3.1.1.7A | STRUCTURAL MATERIALS CRITERIA AND SELECTION – MECHANICAL PROPERTIES | |
| 3.1.1.7B | STRUCTURAL MATERIALS CRITERIA AND SELECTION – MATERIAL SELECTION | |
| 3.1.1.8 | STRUCTURAL DEGRADATION FROM MATERIAL EROSION | |
| 3.1.2 | STRUCTURAL/MECHANICAL INTERFACE WITH THE MOBILE SERVICING SYSTEM | |
| 3.1.2.1 | STRUCTURAL DESIGN INTERFACE | |
| 3.1.2.2 | MECHANICAL DESIGN INTERFACE | |
| 3.1.2.3A | MASS AND ENVELOPE DIMENSIONS – TOTAL MASS | |
| 3.1.2.3B | MASS AND ENVELOPE DIMENSIONS – ENVELOPE | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 2 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.1.3 | STRUCTURAL/MECHANICAL INTERFACE WITH THE INTEGRATED TRUSS SEGMENT S3 PAYLOAD ATTACH SYSTEM AND INTEGRATED TRUSS SEGMENT P3 UNPRESSURIZED CARGO CARRIER ATTACH SYSTEM | |
| 3.1.3.1 | STRUCTURAL/MECHANICAL | |
| 3.1.3.1.1 | PHYSICAL ENVELOPE REQUIREMENTS | |
| 3.1.3.1.1.1 | PAYLOAD ATTACH SYSTEM/UNPRESSURIZED LOGISTICS CARRIER ATTACH SYSTEM ON–ORBIT OPERATIONAL ENVELOPE | |
| 3.1.3.1.1.2 | INTERFACE PLANE PROTRUSION | |
| 3.1.3.1.1.3A | EXTRAVEHICULAR ACTIVITY/ROBOTICS OPERATIONAL ENVELOPE – EVA | |
| 3.1.3.1.1.3B | EXTRAVEHICULAR ACTIVITY/ROBOTICS OPERATIONAL ENVELOPE – ROBOTICS | |
| 3.1.3.1.2 | MASS PROPERTIES AND CENTER OF GRAVITY | |
| 3.1.3.1.2.1 | PAYLOAD ATTACH SYSTEM COORDINATE SYSTEM ORIGIN LOCATION | |
| 3.1.3.1.2.2 | MASS AND CENTER OF GRAVITY | |
| 3.1.3.1.3 | ATTACHED PAYLOAD FUNDAMENTAL FREQUENCY | |
| 3.1.3.1.3.1 | INTERFACE PRELOAD | |
| 3.1.3.1.3.2 | INTERFACE STIFFNESS | |
| 3.1.3.2 | MECHANICAL INTERFACE | |
| 3.1.3.2.1A | EXTRAVEHICULAR ACTIVITY RELEASABLE AND REMOVABLE CAPTURE BAR | |
| 3.1.3.2.1B | EXTRAVEHICULAR ACTIVITY RELEASABLE AND REMOVABLE CAPTURE BAR – DESIGN | |
| 3.1.3.2.2A | GUIDE PINS | |
| 3.1.3.2.2B | GUIDE PINS – DESIGN | |
| 3.1.3.2.3A | PASSIVE UMBILICAL MECHANISM ASSEMBLY – PART SELECTION | |
| 3.1.3.2.3B | PASSIVE UMBILICAL MECHANISM ASSEMBLY – LOCATION | |
| 3.1.3.2.3C | PASSIVE UMBILICAL MECHANISM ASSEMBLY – EVA ACCESS | |
| 3.1.3.2.3.1A | UMA MOUNTING | |
| 3.1.3.2.3.1B | UMA MOUNTING – LOADS | |
| 3.1.3.2.3.1C | UMA MOUNTING – STIFFNESS | |
| 3.1.3.2.3.1D | UMA MOUNTING – TEMPERATURE RANGE | |
| 3.1.3.2.4A | MECHANICAL STOP DESIGN – STRENGTH | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 3 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.1.3.2.4B | MECHANICAL STOP DESIGN – DUTY CYCLES | |
| 3.1.3.2.5 | SAFETY INTERLOCKS | |
| 3.1.3.2.6 | MICROGRAVITY | |
| 3.1.3.2.6.1 | LIMIT QUASI–STEADY ACCELERATIONS | |
| 3.1.3.2.6.2 | LIMIT VIBRATORY AND TRANSIENT ACCELERATIONS | |
| 3.1.3.2.6.2.1 | VIBRATORY REQUIREMENTS | |
| 3.1.3.2.6.2.2 | TRANSIENT REQUIREMENTS | |
| 3.1.3.2.6.3 | ANGULAR MOMENTUM LIMITS | |
| 3.1.3.2.6.3.1 | LIMIT DISTURBANCE INDUCED ISS ATTITUDE RATE | |
| 3.1.3.2.6.3.2 | LIMIT DISTURBANCE INDUCED CMG MOMENTUM USAGE | |
| 3.1.3.2.7 | CONTACT SURFACES | |
| 3.1.4 | INTERFACE WITH SPACE STATION EXTRAVEHICULAR ROBOTICS | |
| 3.1.4.1 | INTERFACE WITH NSTS REMOTE MANIPULATOR SYSTEM AND SPACE STATION REMOTE MANIPULATOR SYSTEM | |
| 3.1.4.1.1 | GRAPPLE FIXTURE LOCATIONS | |
| 3.1.4.1.2 | GRAPPLE FIXTURE STRUCTURAL SUPPORT | |
| 3.1.4.2 | INTERFACE WITH SPECIAL PURPOSE DEXTEROUS MANIPULATOR | |
| 3.1.4.2.1A | SPECIAL PURPOSE DEXTEROUS MANIPULATOR FIXTURE LOCATIONS – STABILIZATION AIDS | |
| 3.1.4.2.1B | SPECIAL PURPOSE DEXTEROUS MANIPULATOR FIXTURE LOCATIONS – LOADS | |
| 3.1.4.2.2 | SPECIAL PURPOSE DEXTEROUS MANIPULATOR FIXTURE STRUCTURAL SUPPORT | |
| 3.2 | ELECTRICAL INTERFACE REQUIREMENTS | |
| 3.2.1 | ELECTRICAL INTERFACE WITH MOBILE SERVICING SYSTEM MCAS | |
| 3.2.2 | ELECTRICAL POWER INTERFACE WITH THE INTEGRATED TRUSS SEGMENT S3 PAYLOAD ATTACH SYSTEM AND P3 UNPRESSURIZED CARGO CARRIER ATTACH SYSTEM | |
| 3.2.2.1 | ELECTRICAL POWER CHARACTERISTICS | |
| 3.2.2.1.1 | STEADY–STATE VOLTAGE CHARACTERISTICS | |
| 3.2.2.1.2 | RIPPLE VOLTAGE CHARACTERISTICS | |
| 3.2.2.1.2.1 | RIPPLE VOLTAGE AND NOISE | |
| 3.2.2.1.2.2 | RIPPLE VOLTAGE SPECTRUM | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 4 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.2.2.1.3 | TRANSIENT VOLTAGES | |
| 3.2.2.1.3.1 | NORMAL TRANSIENT VOLTAGES | |
| 3.2.2.1.3.2 | FAULT CLEARING AND PROTECTION | |
| 3.2.2.1.3.3A | INTERFACE C NON–NORMAL VOLTAGE RANGE – OVERVOLTAGE | |
| 3.2.2.1.3.3B | INTERFACE C NON–NORMAL VOLTAGE RANGE – UNDERVOLTAGE | |
| 3.2.2.2 | ELECTRICAL POWER INTERFACE | |
| 3.2.2.2.1A | ATTACHED PAYLOAD CONNECTORS AND PIN ASSIGNMENTS – CONNECTOR | |
| 3.2.2.2.1B | ATTACHED PAYLOAD CONNECTORS AND PIN ASSIGNMENTS – PIN ASSIGNMENTS | |
| 3.2.2.2.2A | POWER BUS ISOLATION – INDEPENDENT FEEDS | |
| 3.2.2.2.2B | POWER BUS ISOLATION – DIODES | |
| 3.2.2.2.3 | COMPATIBILITY WITH SOFT START/STOP REMOTE POWER CONTROLLER | |
| 3.2.2.2.4A | SURGE CURRENT – AMPLITUDE | |
| 3.2.2.2.4B | SURGE CURRENT – RATE OF CHANGE | |
| 3.2.2.2.5 | REVERSE ENERGY/CURRENT | |
| 3.2.2.2.6 | CIRCUIT PROTECTION DEVICES | |
| 3.2.2.2.6.1A | ISS EPS CIRCUIT PROTECTION CHARACTERISTICS – RPC | |
| 3.2.2.2.6.1B | ISS EPS CIRCUIT PROTECTION CHARACTERISTICS – OVERCURRENT PROTECTION | |
| 3.2.2.2.6.2 | ATTACHED PAYLOAD TRIP RATINGS | |
| 3.2.2.2.7 | INTERFACE C ATTACHED PAYLOAD COMPLEX LOAD | |
| 3.2.2.2.8 | LARGE SIGNAL STABILITY | |
| 3.2.2.3 | ELECTRICAL POWER CONSUMER CONSTRAINTS | |
| 3.2.2.3.1 | WIRE DERATING | |
| 3.2.2.3.2 | EXCLUSIVE POWER FEEDS | |
| 3.2.2.3.3 | LOSS OF POWER | |
| 3.2.2.4 | ELECTROMAGNETIC COMPATIBILITY | |
| 3.2.2.4.1 | ELECTRICAL GROUNDING | |
| 3.2.2.4.2 | ELECTRICAL BONDING | |
| 3.2.2.4.3 | CABLE/WIRE DESIGN AND CONTROL REQUIREMENTS | |
| 3.2.2.4.4 | ELECTROMAGNETIC INTERFERENCE | |
| 3.2.2.4.5A | ELECTROSTATIC DISCHARGE – WARNING | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 5 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.2.2.4.5B | ELECTROSTATIC DISCHARGE – LABELING | |
| 3.2.2.4.6 | ALTERNATING CURRENT MAGNETIC FIELDS | |
| 3.2.2.4.7 | DIRECT CURRENT MAGNETIC FIELDS | |
| 3.2.2.4.8 | CORONA | |
| 3.2.2.4.9 | ELECTROMAGNETIC INTERFERENCES SUSCEPTIBILITY FOR SAFETY CRITICAL CIRCUITS | |
| 3.2.2.5 | SAFETY REQUIREMENTS | |
| 3.2.2.5.1 | PAYLOAD ELECTRICAL SAFETY | |
| 3.2.2.5.1.1 | MATING/DEMATING OF POWERED CONNECTORS | |
| 3.2.2.5.1.2 | SAFETY–CRITICAL CIRCUITS REDUNDANCY | |
| 3.2.2.5.2A | POWER SWITCHES/CONTROLS – OPEN | |
| 3.2.2.5.2B | POWER SWITCHES/CONTROLS – MARKINGS | |
| 3.2.2.5.2C | POWER SWITCHES/CONTROLS – NOMENCLATURE | |
| 3.3 | COMMAND AND DATA HANDLING INTERFACE REQUIREMENTS | |
| 3.3.1 | COMMAND AND DATA HANDLING INTERFACE WITH MOBILE SERVICING SYSTEM | |
| 3.3.2 | COMMAND AND DATA HANDLING INTERFACE WITH THE INTEGRATED TRUSS SEGMENT S3 PAYLOAD ATTACH SYSTEM AND P3 UNPRESURRIZED CARGO CARRIER ATTACH SYSTEM | |
| 3.3.2.1 | WORD/BYTE NOTATIONS, TYPES, AND DATA TRANSMISSIONS | |
| 3.3.2.1.1 | WORD/BYTE NOTATIONS | |
| 3.3.2.1.2 | DATA TYPES | |
| 3.3.2.1.3A | DATA TRANSMISSIONS – LRDL | |
| 3.3.2.1.3B | DATA TRANSMISSIONS – HRDL | |
| 3.3.2.2 | CONSULTATIVE COMMITTEE FOR SPACE DATA SYSTEMS | |
| 3.3.2.2.1A | CONSULTATIVE COMMITTEE FOR SPACE DATA SYSTEMS DATA – KU–BAND | |
| 3.3.2.2.1B | CONSULTATIVE COMMITTEE FOR SPACE DATA SYSTEMS DATA | |
| 3.3.2.2.1.1 | CONSULTATIVE COMMITTEE FOR SPACE DATA SYSTEMS DATA PACKETS | |
| 3.3.2.2.1.1.1 | CONSULTATIVE COMMITTEE FOR SPACE DATA SYSTEMS PRIMARY HEADER | |
| 3.3.2.2.1.1.2A | CONSULTATIVE COMMITTEE FOR SPACE DATA SYSTEMS SECONDARY HEADER – LOCATION | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 6 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.3.2.2.1.1.2B | CONSULTATIVE COMMITTEE FOR SPACE DATA SYSTEMS SECONDARY HEADER – SSP 52050 | |
| 3.3.2.2.1.2 | CONSULTATIVE COMMITTEE FOR SPACE DATA SYSTEMS DATA FIELD | |
| 3.3.2.2.1.3 | CONSULTATIVE COMMITTEE FOR SPACE DATA SYSTEMS APPLICATION PROCESS IDENTIFICATION FIELD | |
| 3.3.2.2.2 | CONSULTATIVE COMMITTEE FOR SPACE DATA SYSTEMS TIME CODES | |
| 3.3.2.2.2.1 | CONSULTATIVE COMMITTEE FOR SPACE DATA SYSTEMS UNSEGMENTED TIME | |
| 3.3.2.2.2.2 | CONSULTATIVE COMMITTEE FOR SPACE DATA SYSTEMS SEGMENTED TIME | |
| 3.3.2.3A | MIL–STD–1553 LOW RATE DATA LINK – SINGLE RT | |
| 3.3.2.3B | MIL–STD–1553 LOW RATE DATA LINK – ADDRESS | |
| 3.3.2.3.1 | MIL–STD–1553 PROTOCOL | |
| 3.3.2.3.1.1A | STANDARD MESSAGES | |
| 3.3.2.3.1.1B | STANDARD MESSAGES – SUBADDRESSES | |
| 3.3.2.3.1.2A | COMMANDING | |
| 3.3.2.3.1.2B | COMMANDING – SUBADDRESSES | |
| 3.3.2.3.1.3A | HEALTH AND STATUS DATA | |
| 3.3.2.3.1.3B | HEALTH AND STATUS DATA – FORMAT | |
| 3.3.2.3.1.3C | HEALTH AND STATUS DATA – RESPONSE | |
| 3.3.2.3.1.4A | SAFETY DATA | |
| 3.3.2.3.1.4B | SAFETY DATA – STANDARD WORDS | |
| 3.3.2.3.1.4.1 | CAUTION AND WARNING | |
| 3.3.2.3.1.4.1.1 | CLASS 1 – EMERGENCY | |
| 3.3.2.3.1.4.1.2A | CLASS 2 – WARNING – PRECURSOR EVENT | |
| 3.3.2.3.1.4.1.2B | CLASS 2 – WARNING – LOSS OF HAZARD CONTROL | |
| 3.3.2.3.1.4.1.3A | CLASS 3 – CAUTION – PRECURSOR EVENT | |
| 3.3.2.3.1.4.1.3B | CLASS 3 – CAUTION – LOSS OF HAZARD CONTROL | |
| 3.3.2.3.1.4.1.4 | CLASS 4 – ADVISORY | |
| 3.3.2.3.1.5 | SERVICE REQUESTS | |
| 3.3.2.3.1.6 | ANCILLARY DATA | |
| 3.3.2.3.1.7 | FILE TRANSFER | |
| 3.3.2.3.1.8 | LOW RATE TELEMETRY | |
| 3.3.2.3.1.9 | DEFINED MODE CODES | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 7 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.3.2.3.1.10 | IMPLEMENTED MODE CODES | |
| 3.3.2.3.1.11 | ILLEGAL COMMANDS | |
| 3.3.2.3.2 | MIL–STD–1553 LRDL INTERFACE CHARACTERISTICS | |
| 3.3.2.3.2.1 | LRDL CONNECTOR/PIN ASSIGNMENTS | |
| 3.3.2.3.2.2A | LRDL SIGNAL CHARACTERISTICS | |
| 3.3.2.3.2.2B | LRDL SIGNAL CHARACTERISTICS – TERMINAL | |
| 3.3.2.3.2.3A | LRDL CABLING – CHARACTERISTICS | |
| 3.3.2.3.2.3B | LRDL CABLING – STUB LENGTH | |
| 3.3.2.4 | HIGH RATE DATA LINK | |
| 3.3.2.4.1 | PAYLOAD TO HIGH RATE FRAME MULTIPLEXER PROTOCOLS | |
| 3.3.2.4.2 | HIGH RATE DATA LINK INTERFACE CHARACTERISTICS | |
| 3.3.2.4.2.1 | PHYSICAL SIGNALING | |
| 3.3.2.4.2.2 | ENCODING | |
| 3.3.2.4.2.3 | SYMBOLS USED IN TESTING | |
| 3.3.2.4.3 | HIGH RATE DATA LINK OPTICAL POWER | |
| 3.3.2.4.3.1 | HIGH RATE DATA LINK TRANSMITTED OPTICAL POWER | |
| 3.3.2.4.3.2 | HIGH RATE DATA LINK RECEIVED OPTICAL POWER | |
| 3.3.2.4.4 | HIGH RATE DATA LINK FIBER OPTIC CABLE | |
| 3.3.2.4.5 | HIGH RATE DATA LINK FIBER OPTIC CABLE BEND RADIUS | |
| 3.3.2.4.6 | HIGH RATE DATA LINK CONNECTORS | |
| 3.3.2.4.7 | HIGH RATE DATA LINK CONNECTOR/PIN ASSIGNMENTS | |
| 3.3.2.5 | PORTABLE COMPUTER SYSTEM | |
| 3.4 | PASSIVE THERMAL CONTROL INTERFACE REQUIREMENTS | |
| 3.4.1 | PASSIVE THERMAL CONTROL INTERFACE WITH THE ITS S3 PAYLOAD ATTACH SYSTEM AND P3 UNPRESSURIZED CARGO CARRIER ATTACH SYSTEM | |
| 3.4.1.1 | PASSIVE THERMAL CONTROL DESIGN REQUIREMENTS FOR PAYLOAD ON THE ITS S3 PAS AND P3 UCCAS | |
| 3.4.1.1.1 | TEMPERATURE REQUIREMENT | |
| 3.4.1.1.2 | DELETED | |
| 3.4.1.1.3 | DELETED | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 8 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.4.1.1.4 | DELETED | |
| 3.4.1.1.5A | THERMAL RADIATION MODELS – DELIVERY | |
| 3.4.1.1.5B | THERMAL RADIATION MODELS – SPECULARITY | |
| 3.4.1.1.6A | THERMAL EXCHANGE BETWEEN PAYLOADS – VIEW FACTOR | |
| 3.4.1.1.6B | THERMAL EXCHANGE BETWEEN PAYLOADS – SPECULARITY | |
| 3.5 | ENVIRONMENT INTERFACE REQUIREMENTS | |
| 3.5.1 | ENVIRONMENTAL CONTROL INTERFACE WITH THE INTEGRATED TRUSS SEGMENT S3 PAYLOAD ATTACH SYSTEM AND P3 UNPRESSURIZED CARGO CARRIER ATTACH SYSTEM | |
| 3.5.1.1 | PRESSURE | |
| 3.5.1.2 | THERMAL ENVIRONMENT | |
| 3.5.1.3 | HUMIDITY | |
| 3.5.1.4 | ATOMIC OXYGEN | |
| 3.5.1.5 | EXTERNAL CONTAMINATION REQUIREMENTS | |
| 3.5.1.5.1 | MOLECULAR COLUMN DENSITY FROM VENTING, LEAKAGE AND OUTGASSING | |
| 3.5.1.5.2A | MOLECULAR DEPOSITION FROM MATERIALS OUTGASSING AND VENTING – OTHER ATTACHED PAYLOADS | |
| 3.5.1.5.2B | MOLECULAR DEPOSITION FROM MATERIALS OUTGASSING AND VENTING – ISS | |
| 3.5.1.5.3 | PARTICULATES | |
| 3.5.1.6 | ELECTROMAGNETIC RADIATION | |
| 3.5.1.7 | PLASMA | |
| 3.5.1.8 | IONIZING RADIATION | |
| 3.5.1.8.1 | ATTACHED PAYLOAD CONTAINED OR GENERATED IONIZING RADIATION | |
| 3.5.1.8.2 | IONIZING RADIATION DOSE | |
| 3.5.1.8.3 | NOMINAL SINGLE EVENT EFFECTS IONIZING RADIATION | |
| 3.5.1.8.4 | EXTREME SINGLE EVENT EFFECTS | |
| 3.5.1.9 | SOLAR ULTRAVIOLET RADIATION | |
| 3.5.1.10 | PLUME IMPINGEMENT | |
| 3.5.1.11 | METEOROIDS AND ORBITAL DEBRIS | |
| 3.5.1.12A | ACCELERATION ENVIRONMENT – NOMINAL | |

**TABLE 4.2–1 APPLICABILITY MATRIX
(Page 9 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.5.1.12B | ACCELERATION ENVIRONMENT – BERTHING | |
| 3.5.1.13 | VIBRATION ENVIRONMENT – LINEAR PEAK LOADS | |
| 3.6 | MATERIALS AND PARTS INTERFACE REQUIREMENTS | |
| 3.6.1 | MATERIALS AND PARTS USE AND SELECTION | |
| 3.6.1.1 | THERMAL VACUUM STABILITY | |
| 3.6.2 | COMMERCIAL PARTS | |
| 3.6.3 | CLEANLINESS | |
| 3.6.4 | ATOMIC OXYGEN INTERACTION | |
| 3.7 | EXTRAVEHICULAR ROBOTICS REQUIREMENTS | |
| 3.7.1A | EQUIPMENT REQUIRING SHUTTLE ROBOTIC SUPPORT – IMPULSE | |
| 3.7.1B | EQUIPMENT REQUIRING SHUTTLE ROBOTIC SUPPORT – CLEARANCE ZONE | |
| 3.7.1C | EQUIPMENT REQUIRING SHUTTLE ROBOTIC SUPPORT – GRAPPLE FIXTURE (GF) | |
| 3.7.1D | EQUIPMENT REQUIRING SHUTTLE ROBOTIC SUPPORT – GF LOCATION | |
| 3.7.1E | EQUIPMENT REQUIRING SHUTTLE ROBOTIC SUPPORT – MASS | |
| 3.7.1F | EQUIPMENT REQUIRING SHUTTLE ROBOTIC SUPPORT – LOADS | |
| 3.7.1G | EQUIPMENT REQUIRING SHUTTLE ROBOTIC SUPPORT – VIBRATION FREQUENCY | |
| 3.7.1H | EQUIPMENT REQUIRING SHUTTLE ROBOTIC SUPPORT – GROUNDING | |
| 3.7.1I | EQUIPMENT REQUIRING SHUTTLE ROBOTIC SUPPORT – THERMAL ISOLATION | |
| 3.7.1J | EQUIPMENT REQUIRING SHUTTLE ROBOTIC SUPPORT – SCUFF PLATES | |
| 3.7.1K | EQUIPMENT REQUIRING SHUTTLE ROBOTIC SUPPORT – SHIELDING | |
| 3.7.1L | EQUIPMENT REQUIRING SHUTTLE ROBOTIC SUPPORT – CONTACT VELOCITY | |
| 3.7.1M | EQUIPMENT REQUIRING SHUTTLE ROBOTIC SUPPORT – CAPTURE ENVELOPE | |
| 3.7.1N | EQUIPMENT REQUIRING SHUTTLE ROBOTIC SUPPORT – READY TO LATCH INDICATION | |
| 3.7.2 | EXTERNAL EQUIPMENT REQUIRING ROBOTIC HAND–OFF | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 10 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.7.3A | EXTERNAL EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT – LEE | |
| 3.7.3B | EXTERNAL EQUIPMENT REQUIRING SPACE STATION RMS SUPPORT – PROPERTIES | |
| 3.7.3C | EXTERNAL EQUIPMENT REQUIRING SPACE STATION RMS SUPPORT – CONTACT CONDITIONS | |
| 3.7.3D | EXTERNAL EQUIPMENT REQUIRING SPACE STATION RMS SUPPORT – BACKDRIVE | |
| 3.7.3E | EXTERNAL EQUIPMENT REQUIRING SPACE STATION RMS SUPPORT – READY TO LATCH | |
| 3.7.3F | EXTERNAL EQUIPMENT REQUIRING SPACE STATION RMS SUPPORT – SCUFF PLATES | |
| 3.7.3G | EXTERNAL EQUIPMENT REQUIRING SPACE STATION RMS SUPPORT – SHIELDING | |
| 3.7.3H | EXTERNAL EQUIPMENT REQUIRING SPACE STATION RMS SUPPORT – CONTACT WITH EQUIPMENT | |
| 3.7.3I | EXTERNAL EQUIPMENT REQUIRING SPACE STATION RMS SUPPORT – SSRMS LIMITS | |
| 3.7.3J | EXTERNAL EQUIPMENT REQUIRING SPACE STATION RMS SUPPORT – CAPTURE ENVELOPE | |
| 3.7.3K | EXTERNAL EQUIPMENT REQUIRING SPACE STATION RMS SUPPORT – GRAPPLE FIXTURE | |
| 3.7.3.1A | EQUIPMENT REQUIRING SSRMS SUPPORT USING A NATIONAL SPACE STATION TRANSPORTATION SYSTEM GRAPPLE FIXTURE – CLEARANCE ENVELOPE | |
| 3.7.3.1B | EQUIPMENT REQUIRING SSRMS SUPPORT USING A NATIONAL SPACE STATION TRANSPORTATION SYSTEM GRAPPLE FIXTURE – GRAPPLE FIXTURE | |
| 3.7.3.1C | EQUIPMENT REQUIRING SSRMS SUPPORT USING A NATIONAL SPACE STATION TRANSPORTATION SYSTEM GRAPPLE FIXTURE – TIP LOADS | |
| 3.7.3.1D | EQUIPMENT REQUIRING SSRMS SUPPORT USING A NATIONAL SPACE STATION TRANSPORTATION SYSTEM GRAPPLE FIXTURE – IMPULSE | |
| 3.7.3.1E | EQUIPMENT REQUIRING SSRMS SUPPORT USING A NATIONAL SPACE STATION TRANSPORTATION SYSTEM GRAPPLE FIXTURE – VIBRATION FREQUENCY | |
| 3.7.3.1F | EQUIPMENT REQUIRING SSRMS SUPPORT USING A NATIONAL SPACE STATION TRANSPORTATION SYSTEM GRAPPLE FIXTURE – THERMAL ISOLATION | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 11 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.7.3.1G | EQUIPMENT REQUIRING SSRMS SUPPORT USING A NATIONAL SPACE STATION TRANSPORTATION SYSTEM GRAPPLE FIXTURE – ELECTRICAL INTERFACE | |
| 3.7.3.2A | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER DATA GRAPPLE FIXTURE – CLEARANCE ENVELOPE | |
| 3.7.3.2B | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER DATA GRAPPLE FIXTURE – STRUCTURAL INTERFACE | |
| 3.7.3.2C | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER DATA GRAPPLE FIXTURE – ELECTRICAL INTERFACE | |
| 3.7.3.2D | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER DATA GRAPPLE FIXTURE – ELECTRICAL POWER INTERFACE | |
| 3.7.3.2E | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER DATA GRAPPLE FIXTURE – DATA INTERFACE | |
| 3.7.3.2F | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER DATA GRAPPLE FIXTURE – VIDEO INTERFACE | |
| 3.7.3.2G | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER DATA GRAPPLE FIXTURE – HARNESS AND CONNECTORS | |
| 3.7.3.2H | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER DATA GRAPPLE FIXTURE – THERMAL CONDUCTANCE | |
| 3.7.3.2I | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER DATA GRAPPLE FIXTURE – EME EFFECTS | |
| 3.7.3.3A | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER VIDEO GRAPPLE FIXTURE – CLEARANCE ENVELOPE | |
| 3.7.3.3B | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER VIDEO GRAPPLE FIXTURE – STRUCTURAL INTERFACE | |
| 3.7.3.3C | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER VIDEO GRAPPLE FIXTURE – ELECTRICAL INTERFACE | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 12 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.7.3.3D | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER VIDEO GRAPPLE FIXTURE – ELECTRICAL POWER INTERFACE | |
| 3.7.3.3E | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER VIDEO GRAPPLE FIXTURE – DATA INTERFACE | |
| 3.7.3.3F | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER VIDEO GRAPPLE FIXTURE – VIDEO INTERFACE | |
| 3.7.3.3G | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER VIDEO GRAPPLE FIXTURE – HARNESS AND CONNECTORS | |
| 3.7.3.3H | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER VIDEO GRAPPLE FIXTURE – THERMAL CONDUCTANCE | |
| 3.7.3.3I | EQUIPMENT REQUIRING SPACE STATION REMOTE MANIPULATOR SYSTEM SUPPORT USING A POWER VIDEO GRAPPLE FIXTURE – EME EFFECTS | |
| 3.7.4A | EXTERNAL EQUIPMENT REQUIRING DEXTEROUS ROBOTIC SUPPORT – INTERFACE | |
| 3.7.4B | EXTERNAL EQUIPMENT REQUIRING DEXTEROUS ROBOTIC SUPPORT – STRUCTURAL LIMITS | |
| 3.7.4C | EXTERNAL EQUIPMENT REQUIRING DEXTEROUS ROBOTIC SUPPORT – OPERATING LIMITS | |
| 3.7.4D | EXTERNAL EQUIPMENT REQUIRING DEXTEROUS ROBOTIC SUPPORT – WORKSITES | |
| 3.7.4E | EXTERNAL EQUIPMENT REQUIRING DEXTEROUS ROBOTIC SUPPORT – TEMPORARY STORAGE | |
| 3.7.5A | EQUIPMENT REQUIRING ROBOTIC TRANSLATION – STRUCTURAL LIMITS | |
| 3.7.5B | EQUIPMENT REQUIRING ROBOTIC TRANSLATION – SSRMS AND POA | |
| 3.7.5C | EQUIPMENT REQUIRING ROBOTIC TRANSLATION – NO POWER, DATA, VIDEO | |
| 3.7.5D | EQUIPMENT REQUIRING ROBOTIC TRANSLATION – TRANSLATION CORRIDOR | |
| 3.7.6 | EBCS AVIONICS PACKAGE | |
| 3.7.6.1A | EBCS AVIONICS PACKAGE ENVELOPE AND MOUNTING – OPERATIONAL ENVELOPE AND OPTICAL KEEP–OUT ZONE | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 13 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.7.6.1B | EBCS AVIONICS PACKAGE ENVELOPE AND MOUNTING – LOCATION | |
| 3.7.6.1C | EBCS AVIONICS PACKAGE ENVELOPE AND MOUNTING – MAINTAIN LOCATION | |
| 3.7.6.2.A | EBCS AVIONICS PACKAGE POWER – CABLE ROUTING AND CONNECTIONS | |
| 3.7.6.2B | EBCS AVIONICS PACKAGE POWER – KEEP–ALIVE HEATER POWER | |
| 3.7.6.3A | EBCS THERMAL REQUIREMENTS – THERMAL CONDUCTIVITY | |
| 3.7.6.3B | EBCS THERMAL REQUIREMENTS – NON–OPERATIONAL ON–ORBIT | |
| 3.7.6.3C | EBCS THERMAL REQUIREMENTS – OPERATIONAL ON–ORBIT | |
| 3.7.6.4 | EBCS VIBRATION REQUIREMENTS | |
| 3.7.6.5 | EBCS AVIONICS PACKAGE VIDEO | |
| 3.8A | EXTRAVEHICULAR ACTIVITY – CONTINGENCY EVA | |
| 3.8B | EXTRAVEHICULAR ACTIVITY – SHARP EDGE, PROTRUSION, GLOVE TEMPERATURE | |
| 3.8.1A | EXTRAVEHICULAR ACTIVITY AS A BACKUP FOR ROBOTICS ACTIVITIES – EVA AIDS | |
| 3.8.1B | EXTRAVEHICULAR ACTIVITY AS A BACKUP FOR ROBOTICS ACTIVITIES – ATTACHMENT POINTS OR RESTRAINTS | |
| 3.8.1C | EXTRAVEHICULAR ACTIVITY AS A BACKUP FOR ROBOTICS ACTIVITIES – FORCE REACTION | |
| 3.8.2 | EXTRAVEHICULAR ACTIVITY TRANSLATION | |
| 3.8.2.1 | PAYLOAD ATTACH SYSTEM/UNPRESSURIZED CARGO CARRIER ATTACH SYSTEM INTERFACE CLEARANCES | |
| 3.8.2.2 | EXTRAVEHICULAR ACTIVITY TRANSLATION CORRIDOR PROTRUSION | |
| 3.8.3 | HUMAN ENGINEERING DESIGN | |
| 3.8.3.1 | CREW ACCESS DIMENSIONS | |
| 3.8.3.1.1 | BODY ENVELOPE AND REACH ACCESSIBILITY | |
| 3.8.3.1.1.1A | CENTERING – LEFT OR RIGHT | |
| 3.8.3.1.1.1B | CENTERING – ABOVE OR BELOW | |
| 3.8.3.1.1.2 | EXTRAVEHICULAR ACTIVITY CREWMEMBER FIELD OF VIEW | |
| 3.8.3.1.1.3 | EXTERNAL TASK LOCATION REQUIREMENTS | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 14 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.8.3.2 | STRENGTH REQUIREMENTS | |
| 3.8.3.2.1 | EXTERNAL LIMIT LOADS | |
| 3.8.3.2.2 | EXTRAVEHICULAR ACTIVITY ACTUATED CONTROLS | |
| 3.8.3.3 | MOBILITY AIDS AND RESTRAINTS | |
| 3.8.3.3.1 | PROVIDE EXTRAVEHICULAR ACTIVITY HANDLES | |
| 3.8.3.3.1.1A | EXTRAVEHICULAR ACTIVITY HANDHOLDS/HANDRAILS – DESIGN | |
| 3.8.3.3.1.1B | EXTRAVEHICULAR ACTIVITY HANDHOLDS/HANDRAILS – ORIENTATION | |
| 3.8.3.3.1.2 | DIMENSIONS | |
| 3.8.3.3.1.3A | MOUNTED CLEARANCE – HANDRAIL TO SURFACE | |
| 3.8.3.3.1.3B | MOUNTED CLEARANCE – GRASP AREAS | |
| 3.8.3.3.1.3C | MOUNTED CLEARANCE – CLEARANCES | |
| 3.8.3.3.1.4A | POSITIONING/LOCATION – POSITIONING | |
| 3.8.3.3.1.4B | POSITIONING/LOCATION – REMOVAL DIRECTION | |
| 3.8.3.3.1.4C | POSITIONING/LOCATION – HAZARD COLOR CODING | |
| 3.8.3.3.1.5A | NON–FIXED HANDLES DESIGN – STOP POSITION | |
| 3.8.3.3.1.5B | NON–FIXED HANDLES DESIGN – USE POSITION | |
| 3.8.3.3.1.5C | NON–FIXED HANDLES DESIGN – LOCKED/UNLOCKED STATUS | |
| 3.8.3.3.1.6 | HANDRAIL/HANDHOLD TETHER ATTACHMENT | |
| 3.8.3.3.1.7 | DANGER WARNINGS | |
| 3.8.3.3.1.8 | COLOR | |
| 3.8.3.3.2 | EXTRAVEHICULAR ACTIVITY SAFETY TETHERS AND SAFETY HOOKS | |
| 3.8.3.3.2.1A | TETHER ATTACH POINTS – STANDARD HOOK | |
| 3.8.3.3.2.1B | TETHER ATTACH POINTS – ITEM SECURING | |
| 3.8.3.3.2.1C | TETHER ATTACH POINTS – DESIGN | |
| 3.8.3.4 | GLOVED OPERATION | |
| 3.8.3.4.1 | EXTRAVEHICULAR ACTIVITY GLOVE HAND ACCESS | |
| 3.8.3.5 | LOCATION CODING | |
| 3.8.4 | HUMAN ENGINEERING SAFETY | |
| 3.8.4.1 | EXTERNAL TOUCH TEMPERATURE | |
| 3.8.4.1.1 | INCIDENTAL CONTACT | |
| 3.8.4.1.2 | UNLIMITED CONTACT | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 15 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.8.4.2 | EQUIPMENT CLEARANCE FOR ENTRAPMENT HAZARDS | |
| 3.8.4.2.1 | EXTERNAL CORNER AND EDGE PROTECTION | |
| 3.8.4.2.1.1 | SHARP EDGES | |
| 3.8.4.2.1.1.1A | EXPOSED EDGE REQUIREMENTS – .25 INCHES + | |
| 3.8.4.2.1.1.1B | EXPOSED EDGE REQUIREMENTS – .12 TO .25 INCHES | |
| 3.8.4.2.1.1.1C | EXPOSED EDGE REQUIREMENTS – .02 TO .12 INCHES | |
| 3.8.4.2.1.1.1D | EXPOSED EDGE REQUIREMENTS – .02 INCHES – | |
| 3.8.4.2.1.1.2A | EXPOSED CORNER REQUIREMENTS – 1.0 INCHES – | |
| 3.8.4.2.1.1.2B | EXPOSED CORNER REQUIREMENTS – 1.0 INCHES + | |
| 3.8.4.2.1.2 | THIN MATERIALS | |
| 3.8.4.2.2 | BURRS | |
| 3.8.4.2.3 | HOLES | |
| 3.8.4.2.3.1 | HANDRAILS/HOLDS | |
| 3.8.4.2.4 | PINCH POINTS | |
| 3.8.4.2.5 | PROTECTIVE COVERS FOR PORTABLE EQUIPMENT | |
| 3.8.4.2.6 | LATCHES | |
| 3.8.4.2.6.1A | DESIGN – ENTRAPMENT | |
| 3.8.4.2.6.1B | DESIGN – GAP | |
| 3.8.4.2.6.1C | DESIGN – OVER CENTER LATCHES | |
| 3.8.4.2.6.1D | DESIGN – CATCHES | |
| 3.8.4.2.6.1E | DESIGN – HANDLE | |
| 3.8.4.2.6.2 | PROTECTIVE COVERS OR GUARDS | |
| 3.8.4.2.7 | CAPTIVE PARTS | |
| 3.8.4.2.7.1 | SCREWS AND BOLTS | |
| 3.8.4.2.7.2 | SECURING PINS | |
| 3.8.4.2.7.3 | LOCKING WIRES | |
| 3.8.4.2.8 | SAFETY CRITICAL FASTENERS | |
| 3.8.4.2.9 | LEVERS, CRANKS, HOOKS AND CONTROLS | |
| 3.8.4.3 | MOVING OR ROTATING EQUIPMENT | |
| 3.8.4.4 | POWER SOURCES | |
| 3.8.4.5 | TRANSMITTERS | |
| 3.9 | MAINTAINABILITY AND MAINTENANCE | |
| 3.9.1 | QUALITATIVE MAINTAINABILITY DESIGN | |
| 3.9.1.1 | FAILURE DETECTION, ISOLATION AND RECOVERY | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 16 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.9.1.1.1A | MANUAL FAILURE DETECTION, ISOLATION AND RECOVERY – HUMAN/EQUIPMENT INTERFACES | |
| 3.9.1.1.1B | MANUAL FAILURE DETECTION, ISOLATION AND RECOVERY – LIGHTING | |
| 3.9.1.1.1C | MANUAL FAILURE DETECTION, ISOLATION AND RECOVERY – AUDIBLE CAUTION AND WARNING DEVICES | |
| 3.9.1.1.1D | MANUAL FAILURE DETECTION, ISOLATION AND RECOVERY – NO DATA | |
| 3.9.1.1.1E | MANUAL FAILURE DETECTION, ISOLATION AND RECOVERY – ONE TIME USE | |
| 3.9.1.2 | RESERVED | |
| 3.9.1.3A | ACCESS – GEOMETRY | |
| 3.9.1.3B | ACCESS – ORU REMOVAL | |
| 3.9.1.3C | ACCESS – SSP 50005 | |
| 3.9.1.3D | ACCESS – REAR | |
| 3.9.1.4A | NONPRESSURIZED AREA EQUIPMENT MAINTENANCE TIME – LESS THAN 3 HOURS | |
| 3.9.1.4B | NONPRESSURIZED AREA EQUIPMENT MAINTENANCE TIME – MORE THAN 3 HOURS | |
| 3.9.1.5 | ACCESS ITEM RETAINMENT | |
| 3.9.1.5.1 | CAPTIVE PARTS | |
| 3.9.1.6 | INSTALLATION/REMOVAL | |
| 3.9.1.6.1 | METHOD | |
| 3.9.1.6.2 | EQUIPMENT ITEM INTERCONNECTING DEVICES | |
| 3.9.1.6.3 | INCORRECT EQUIPMENT INSTALLATION | |
| 3.9.1.6.4 | LOCKWIRING AND STAKING | |
| 3.9.1.6.5A | RESTRAINING AND HANDLING DEVICES FOR TEMPORARY STORAGE – EVA CREW | |
| 3.9.1.6.5B | RESTRAINING AND HANDLING DEVICES FOR TEMPORARY STORAGE – ROBOTICS | |
| 3.9.1.6.6 | INSTALLATION/REMOVAL FORCE | |
| 3.9.1.6.6.1 | DIRECTION OF REMOVAL | |
| 3.9.1.6.6.2 | VISIBILITY | |
| 3.9.1.6.6.3A | MOUNTING ALIGNMENT – DESIGN, LABEL, MARKING | |
| 3.9.1.6.6.3B | MOUNTING ALIGNMENT – ALIGNMENT MARKS | |
| 3.9.1.6.6.3C | MOUNTING ALIGNMENT – CONNECTORS | |
| 3.9.1.6.7 | ORBITAL REPLACEMENT UNIT | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 17 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.9.1.6.7.1 | CAPTURE LATCH ASSEMBLY AND UMBILICAL MECHANICAL ASSEMBLY EVA OVERRIDE | |
| 3.9.1.6.7.2 | PAYLOAD ATTACH SYSTEM AND UNPRESSURIZED CARGO CARRIER ATTACH SYSTEM ORBITAL REPLACEMENT UNIT EXTRAVEHICULAR ACTIVITY MAINTENANCE | |
| 3.9.1.6.7.3 | ATTACHED PAYLOAD REMOVE/REPLACE ITEMS | |
| 3.9.1.7A | STANDARD EVA/EVR INTERFACES – EVA | |
| 3.9.1.7B | STANDARD EVA/EVR INTERFACES – EVR | |
| 3.9.1.7.1 | EXTRAVEHICULAR ACTIVITY TOOLS | |
| 3.9.1.7.1.1A | TOOL CLEARANCE – 90 DEGREE THROW | |
| 3.9.1.7.1.1B | TOOL CLEARANCE – 3 INCH CLEARANCE | |
| 3.9.1.7.1.1C | TOOL CLEARANCE – HEAD CLEARANCE | |
| 3.9.1.7.2A | PAYLOAD HARDWARE AND EQUIPMENT MOUNTING – DESIGN, LABEL, MARKS | |
| 3.9.1.7.2B | PAYLOAD HARDWARE AND EQUIPMENT MOUNTING – ALIGNMENT MARKS | |
| 3.9.1.7.3 | CONNECTORS | |
| 3.9.1.7.3.1A | ONE HANDED OPERATION – MATE/DEMATE | |
| 3.9.1.7.3.1B | ONE HANDED OPERATION – RIGHT/LEFT HAND | |
| 3.9.1.7.3.2A | MATE/DEMATE – ONE CONNECTOR | |
| 3.9.1.7.3.2B | MATE/DEMATE – NO DAMAGE | |
| 3.9.1.7.3.3A | CONNECTOR ARRANGEMENT – SPACING | |
| 3.9.1.7.3.3B | CONNECTOR ARRANGEMENT – CLEARANCE | |
| 3.9.1.7.3.3.1 | STATUS | |
| 3.9.1.7.3.4 | CONNECTOR PROTECTION | |
| 3.9.1.7.3.4.1 | PROTECTING CAPS | |
| 3.9.1.7.3.5A | CODING – CODE OR IDENTIFIER | |
| 3.9.1.7.3.5B | CODING – LOCATION | |
| 3.9.1.7.3.6 | PIN IDENTIFICATION | |
| 3.9.1.7.3.7 | ORIENTATION | |
| 3.9.1.7.3.7.1A | SPACING – SSP 50005 | |
| 3.9.1.7.3.7.1B | SPACING – WING CONNECTORS | |
| 3.9.1.7.4A | CABLE RESTRAINTS – LOOSE ENDS | |
| 3.9.1.7.4B | CABLE RESTRAINTS – EVA CLAMPS | |
| 3.9.1.7.4C | CABLE RESTRAINTS – CLAMPS | |
| 3.9.1.7.4D | CABLE RESTRAINTS – BUNDLED | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 18 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.9.1.7.5A | COVERS – ACCESS | |
| 3.9.1.7.5B | COVERS – REMOVEABLE | |
| 3.9.1.7.5C | COVERS – LOCK INDICATOR | |
| 3.9.1.7.5D | COVERS – EVA LOADS | |
| 3.9.1.7.5E | COVERS – OPENING INTERFERENCE | |
| 3.9.1.7.5F | COVERS – SELF–SUPPORTING | |
| 3.9.1.7.5G | COVERS – HOUSINGS | |
| 3.9.1.7.5H | COVERS – SEALING AREAS | |
| 3.9.1.7.6 | FASTENERS | |
| 3.9.1.7.6.1A | ENGAGEMENT STATUS INDICATION – VISUALLY ACCESSIBLE | |
| 3.9.1.7.6.1B | ENGAGEMENT STATUS INDICATION – ENGAGEMENT STATUS | |
| 3.9.1.7.6.2 | ONE–HANDED ACTUATION | |
| 3.9.1.7.6.3A | FASTENER CLEARANCES – 3 INCHES | |
| 3.9.1.7.6.3B | FASTENER CLEARANCES – SEPARATION | |
| 3.9.1.7.6.3C | FASTENER CLEARANCES – RECESSED | |
| 3.9.1.7.6.4 | FASTENER ACCESS HOLES | |
| 3.9.1.7.6.5A | CAPTIVE FASTENERS – EXTERNAL | |
| 3.9.1.7.6.5B | CAPTIVE FASTENERS – NO TEMPORARY | |
| 3.9.1.7.6.6A | QUICK RELEASE FASTENERS – ONE TURN | |
| 3.9.1.7.6.6B | QUICK RELEASE FASTENERS – POSITIVE LOCK | |
| 3.9.1.7.6.7A | OVER CENTER LATCHES – REALIGNMENT | |
| 3.9.1.7.6.7B | OVER CENTER LATCHES – CATCHES | |
| 3.9.1.7.6.7C | OVER CENTER LATCHES – HANDLE | |
| 3.9.1.7.6.8A | FASTENER HEADS AND KNOBS – DIAMETERS | |
| 3.9.1.7.6.8B | FASTENER HEADS AND KNOBS – HEAD HEIGHT | |
| 3.9.1.7.6.9A | CONTINGENCY OVERRIDE – HEXAGONAL | |
| 3.9.1.7.6.9B | CONTINGENCY OVERRIDE – NO COTTER KEYS | |
| 3.9.1.7.7 | CONTROLS AND DISPLAYS | |
| 3.9.1.7.7.1 | CONTINGENCY EVA CONTROLS | |
| 3.9.1.7.7.1A | CONTINGENCY EVA CONTROLS – POSITION | |
| 3.9.1.7.7.1B | CONTINGENCY EVA CONTROLS – INADVERTENT OPERATION | |
| 3.9.1.7.7.2A | DISPLAYS – SSP 50005 | |
| 3.9.1.7.7.2B | DISPLAYS – FIELD OF VIEW | |

**TABLE 4.2–1 APPLICABILITY MATRIX**
**(Page 19 of 19)**

| IRD PARAGRAPH | IRD REQUIREMENT | PAYLOAD APPLICABILITY |
|---|---|---|
| 3.9.1.7.7.3 | LABELING | |
| 3.9.2 | MAINTENANCE | |
| 3.9.2.1 | PLANNED MAINTENANCE AND STORAGE | |
| 3.9.2.2A | ON–ORBIT MAINTENANCE – MOBILITY AIDS AND RESTRAINTS | |
| 3.9.2.2B | ON–ORBIT MAINTENANCE – EVA TOOLS | |
| 3.9.2.2.1 | CORRECTIVE MAINTENANCE | |
| 3.9.2.2.2 | IN SITU MAINTENANCE | |
| 3.9.2.2.3 | ORU INTERMEDIATE MAINTENANCE | |
| 3.9.2.2.4 | PREVENTIVE MAINTENANCE | |
| 3.9.2.2.5 | ON–ORBIT MAINTENANCE BACK–UP | |
| 3.9.2.2.6 | ACCESS FOR ON–ORBIT MAINTENANCE | |
| 3.9.2.2.6.1 | EVA ACCESS TO FASTENERS | |
| 3.9.2.2.7 | STANDARD ON–ORBIT DIAGNOSTIC EQUIPMENT | |
| 3.9.2.3 | GROUND MAINTENANCE | |
| 3.10A | NAMEPLATES AND PRODUCT MARKING | |
| 3.10B | NAMEPLATES AND PRODUCT MARKING – STRUCTURAL INTEGRITY | |

## 5.0 EXCEPTION PROCESSING

Any exception to requirements, capabilities, or services defined in a payload IRD and/or interfaces defined in the ICD template must be submitted under specific procedures and guidelines to assure proper control, evaluation and approval. This section describes the process by which an Attached Payload–proposed non–compliance to an IRD requirement, or to the interfaces defined in this document, is processed and dispositioned. The Attached Payload non–compliances are referred to in this document as *Exceptions*. The conditions of the Exception will determine further classification as an Exceedance, Deviation or Waiver. The definitions of exceedance, deviation, and waiver are provided in Section 5.1. The specific requirement or interface excepted, along with a description of the existing condition, and a rationale for acceptance will be documented in the Attached Payload unique ICD. Section 5.0 of this document describes how exceptions are documented. It also describes how the ISS PIRN Technical Review (PTR) panel processes Exceptions, and provides for disposition either directly or through appropriate Program Control Boards (PCBs). An overview of the documentation, approval, and implementation flow of Exception requests is provided in Figure 5–1.

# Overview
# Exceedance, Deviation and Waiver Processing

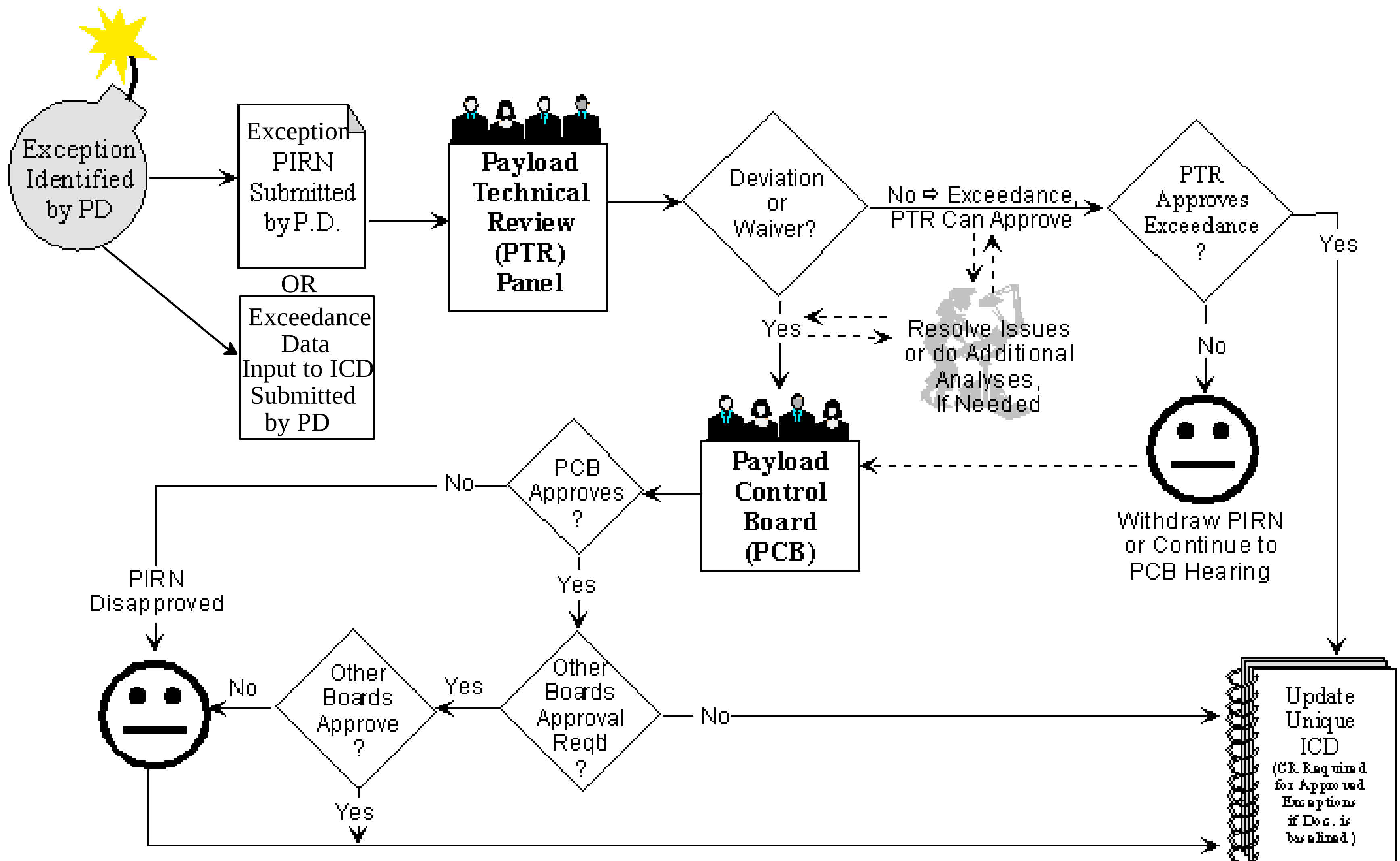



FIGURE 5–1 OVERVIEW OF EXCEPTION PROCESS

## 5.1 DEFINITIONS

### 5.1.1 EXCEPTION

The general term used to identify any Attached Payload departure from specified requirements or interfaces. An Exception is further classified as an Exceedance, Deviation or Waiver per the descriptions provided below.

### 5.1.2 EXCEEDANCE

An Exceedance is a condition that does not comply with a stated IRD requirement or ICD Template interface. It exceeds the defined payload limits but when combined with the remaining payload complement the ISS limits are not exceeded, or it does not impact the performance of the remaining payload complement, and it does not impact vehicle subsystem performance. The exception can be shown to be acceptable within the framework of the standard element level analysis cycle without any unique analysis or controls.

An Exceedance can be approved by the PTR and documented in the unique payload ICD. Exceedances do not require approval by a control board.

### 5.1.3 DEVIATION

A Deviation is a non–compliance to an IRD requirement or ICD Template interface. It is different from an Exceedance in that the defined Exception exceeds ISS limits. Additional analysis outside the scope of the standard element analysis cycle or unique operational guidelines or constraints may be needed to approve the Exception. Deviations must be approved by a control board.

### 5.1.4 WAIVER

A Waiver is any condition found in non–compliance to an IRD requirement or to the baselined Attached Payload unique ICD. Typically this will occur as a result of the final as–built hardware verification program. It may require additional analysis outside of the scope of the standard element analysis cycle or unique operational guidelines or constraints to approve the Exception. Waivers must be approved by a control board.

## 5.2 EXCEPTION PROCESSING DETAILS

All proposed Exceptions to requirements are evaluated by the PTR panel. The PTR is part of the ISS Payload Program office. Exceedances may be approved by the PTR and documented in the Attached Payload unique ICD. Approval/Disposition signature authority rests with the PTR for Exceptions.

The PCB has authority to approve Exceptions that impact the overall payload complement but do not affect overall ISS requirements.

Exceptions that affect ISS subsystems must be approved by the Development Control Board (DCB).

Evaluation is conducted by reviewers of the appropriate technical or program discipline. Their comments are provided as part of the Exception–PIRN disposition either to the PTR, the PCB, or the DCB, according to the criteria discussed above.

### 5.2.1 EXCEPTION LOGGING AND TRACEABILITY

The Attached Payload unique ICD identifies each Exception pertaining to it, and shows traceability to its applicable IRD requirement (section). The approved non–compliant condition will be documented in Appendix C of the Attached Payload unique ICD.

### 5.2.2 EXCEPTIONS TABLE

The Attached Payload unique ICD contains a table of Exceptions per Table 5.2.2–1 which provides the following information concerning each Exception.

The paragraph number of the IRD requirement and the corresponding ICD paragraph number that is proposed to be excepted is entered in the first column of the table. When the classification (i.e., Exceedance, Waiver, or Deviation) is determined, it will be listed in column 2. Until the classification is determined, the item will be listed simply as an Exception. A unique identifier will be assigned to each Exception. A short description of the Exception will be included in column 4. The status of the Exception will be listed as 'Open' until the Exception has been approved by the appropriate authority. Once approved, the PIRN number and the Space Station Change Notice (SSCN) will be listed in the status column to document approval.

**TABLE 5.2.2–1 EXCEPTIONS TABLE**

| IRD/ICD PARAGRAPH NUMBER | CLASSIFICATION | IDENTIFIER (REFERENCE #) | DESCRIPTION | STATUS |
|---|---|---|---|---|
| List the Corresponding IRD and ICD Paragraph # | Classify Exception as an Exceedance, Deviation or Waiver | Unique Identification Number | Provide a Short Description of the Exception | Open or PIRN No./SSCN |

### 5.2.3 PROCESS

Figure 5.2.3–1 reflects the process for proposal, evaluation, and disposition of exceptions.

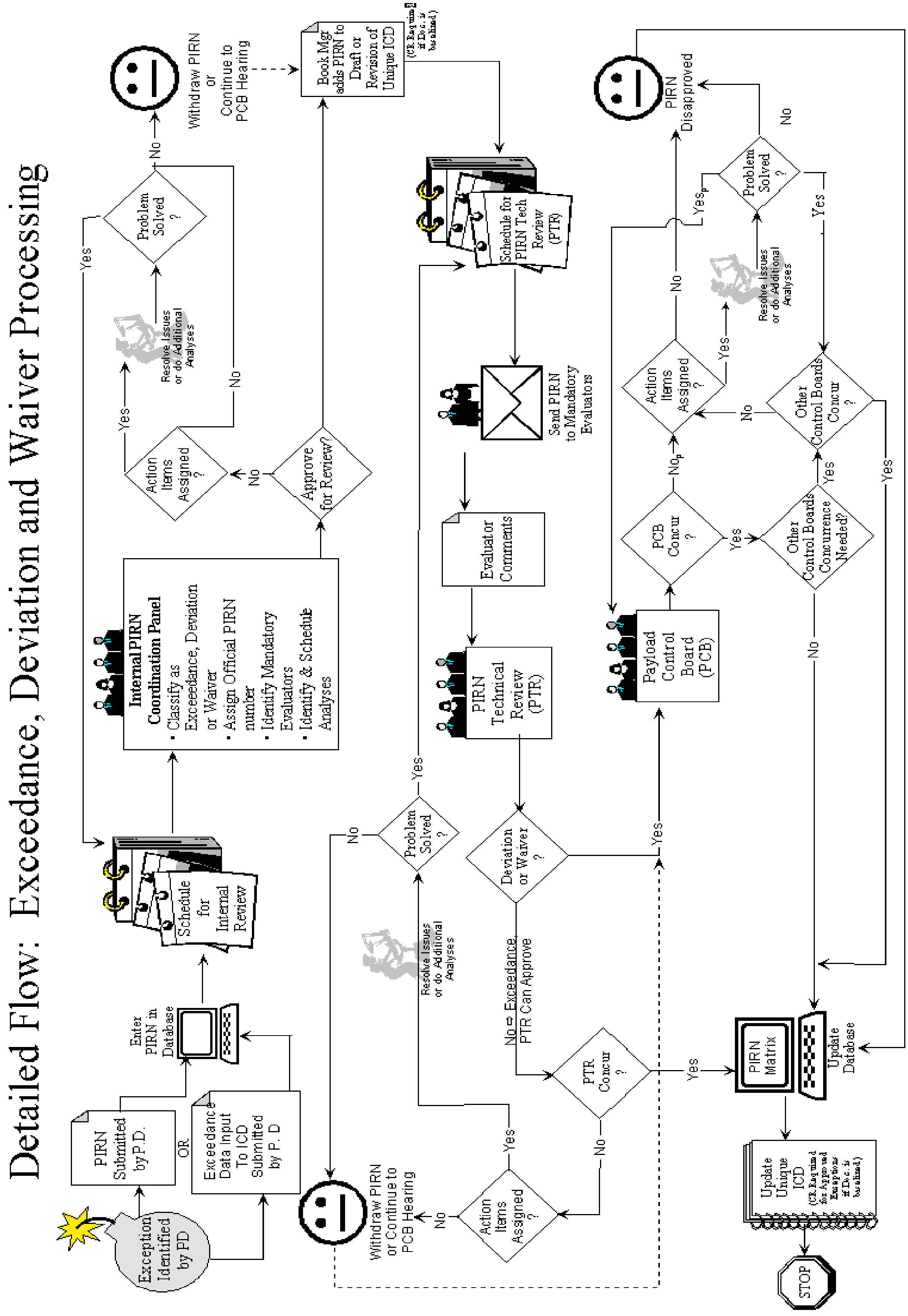



**FIGURE 5.2.3–1 EXCEPTION PROCESS**

### 5.2.3.1 SUBMITTAL REQUESTS

The Attached Payload developer will be responsible for submitting any required Exception Requests. Once the need for an exception is identified, the first step in submitting a request is to provide the pertinent information on an Exception/PIRN form or for Exceedances, data defining the requirement being excepted, a description of the exception, and rationale for acceptance. The Exception/PIRN form and instructions for completion may be obtained from the Payloads Office Documents Web Page.

#### 5.2.3.1.1 DATA SUBMITTAL RESPONSIBILITY

The Attached Payload developer is responsible for providing data that is needed to evaluate the Exception Request for approval. Data, in addition to the data submitted with the Exception Request or contained in the payload unique ICD may be required to evaluate the Exception. The Attached Payload developer must supply the required additional data before the Exception Request process can be completed. The Payload Office may, at its discretion, assist in data collection, analysis, or issue resolution, but this is done as a courtesy only, depending upon available labor, time and resources.

### 5.2.3.2 RECORDING AND MAINTENANCE

The book manager of an Attached Payload unique ICD collects all Exception Requests. Once a request is submitted, the book manager verifies that sufficient information has been provided, assigns a preliminary tracking number, and records the necessary information in a database. Additional data may be requested at any time during the Exception review process.

### 5.2.3.3 INTERNAL SCREENING

When the Attached Payload unique ICD book manager receives an exception request, he/she coordinates the initial review phase with the Internal PIRN Coordination (IPC) meeting. The IPC is co–chaired by representatives of the payload integration offices of NASA and Boeing, and is supported by the ICD book managers or other initiators of each exception. The IPC will classify the exception request as either an exceedance, deviation, or waiver. The IPC will identify whether the Exception potentially impacts vehicle subsystem performance and will assign mandatory evaluators based upon this assessment.

The IPC panel is an informal venue for assuring that the wording and formatting of the Exception–PIRN are correct, and that the technical content of each request merits formal review. The request may be approved for formal review as–is, or the IPC panel may request additional information or some action. If the IPC panel concludes that the Exception request is unacceptable, the panel may request that the Exception–PIRN be withdrawn by the Attached Payload developer.

### 5.2.3.4 PREPARATION FOR FORMAL REVIEW

If an Exception Request is approved for formal review, the IPC assigns a classification of exceedance, deviation or waiver (based on the definitions provided in section 5.1 of this document), assigns a Technical Lead within OZ3 (typically the ICD book manager), assigns the Mandatory Evaluators, and assigns the tracking number. The Exception Request is routed to the designated Mandatory Evaluators via the standard PIRN review process.

### 5.2.3.5 FORMAL REVIEW

#### 5.2.3.5.1 PAYLOAD ENGINEERING INTEGRATION ANALYSIS

The IPC will route the Exception Request to the appropriate Payload Engineering Integration (PEI) discipline for assessment. The PEI Discipline Representative will perform an analysis of the Exception Request which will determine whether the Exception can be approved or not. The PEI Discipline Representative will coordinate with any groups outside of PEI which must participate in the analysis of the Exception Request. If the Exception does not impact the integrated payload complement, the analysis can be performed upon receipt of the Exception Request. If the Exception impacts the integrated payload complement the Exception must be analyzed as part of the standard Element Analysis process. The PEI Discipline analysis will identify any operational constraints that are required to approve the Exception. Any identified operational constraints will be documented in the Payload Operations Guidelines and Constraints document, (SSP 57500 series). The Exception Request will be updated by the Technical Lead to incorporate the PEI analysis results. The updated Exception Request will then be routed to the mandatory evaluators for assessment. The mandatory evaluators will provide their recommendations to the Technical Lead for presentation to the PTR. Any issues and/or comments generated during the PEI Analysis process or by the mandatory evaluators will be coordinated with the Attached Payload developer by the Technical Lead.

#### 5.2.3.5.2 PIRN TECHNICAL REVIEW

Each Exception may be dispositioned at a different board level depending on its classification and/or the timing of the request submittal (prior to or after ICD baseline). All Exception requests (regardless of classification) must first be dispositioned through the PTR. The PTR has approval authority for those exceptions that are classified as Exceedances. The PTR assesses the Exception Request, results of the PEI Analysis, and the mandatory evaluators recommendations. The PTR may approve the Exception Request, disapprove the Exception Request or may request additional data from the Attached Payload developer or PEI Discipline representative in order to be able to adequately assess the Exception Request. The Technical Lead will update the Exception Request to incorporate the PTR’s recommendation.

If the approved Exception Request is classified as an Exceedance it is incorporated into the Attached Payload unique hardware ICD. If the Exception Request is classified as a Deviation or Waiver it is forwarded to the PCB or DCB with a recommendation from the PTR.

If the Exception Request is disapproved, the Attached Payload developer is requested to provide cost and schedule impacts to modify the design/hardware to eliminate the noncompliance. The Exception Request with the PTR's recommendation to disapprove and the cost/schedule impact data are brought to the PCB or DCB for final disposition regardless of classification.

#### 5.2.3.5.3 CONTROL BOARDS

Exception Requests classified as Deviations or Waivers must be assessed and approved by the appropriate Control Board(s). The PCB assesses the Exception Requests, the PEI Analysis results, the mandatory evaluators recommendations, and the PTR recommendations forwarded by the PTR. The PCB will either recommend forwarding the Exception Request to the DCB or the MPICB as appropriate, or direct the Attached Payload developer to modify hardware to meet the IRD requirement in question. PEI and the Attached Payload developer will coordinate the Exception Request with the DCB and/or MPICB as required to gain approval of the Exception. An approved Exception Request is incorporated into the unique hardware ICD.

#### 5.2.3.5.4 SAFETY EXCEPTIONS

Exceptions (non–compliances) to safety requirements are handled by the Payload Safety Review Panel, with final approval from the Joint Mission Integration Control Board and the Joint Program Review Control Board.

### 5.2.4 OPERATIONAL CONSTRAINTS

Most ISS Attached Payloads will be on–orbit for more than one stage, and will be included within more than one payload complement. Exceptions that are granted which impact the integrated payload complement must be reassessed during the element analysis cycle for each subsequent increment. Any operational constraints associated with the Exception may be modified as required for each subsequent Increment and will be documented in the Payload Operations Guidelines and Constraints document for that increment.

## 5.3 EXCEPTION REQUEST FORMAT

The following is provided as an example of how to structure an Exception Request.

| IRN NO: | **ISS PAYLOAD OFFICE IRN/PIRN/EXCEPTION FORM** | **(Page 1 of 1)**<br>DATE PREPARED: **06/02/00** |
|---|---|---|
| Doc. No., Rev. & Title: **SSP 57230**<br>**QUASAR Hardware ICD** | | PIRN NO: **SSP 57230–NA–0001** |
| (P)IRN TITLE: **Deviation Approval Request For On–Orbit Operational Envelope** | | |
| ORIGINATOR:<br>Name: **John Smith**<br>Agency: **QUASAR**<br>Phone: **111–222–3456**<br>Fax: **111–222–3457** | PIRN Type: *Check One*<br>☐ Standard PIRN<br>☒ Exception | *For Payload Office Use Only*<br>☒ Exceedance<br>☐ Deviation<br>☐ Waiver |
| UTILIZATION CHANGE ENGINEER.:<br>Name: **Betty Smith**<br>Agency: **MAGNUM**<br>Phone: **010–123–9876** | SSCN/CR:<br>**None** | RELATED PIRN NO.:<br>**None** |
| Agency Tracking No.:<br>**Leave this blank** | SYSTEM/ELEMENT AFFECTED:<br>**None** | |
| REASON FOR CHANGE: (INCLUDE APPLICABLE ICAP NUMBER)<br>**The QUASAR design violates paragraph 3.1.3.7.1.2 of SSP 57003 limiting the onboard operational envelope of attached payloads to R90.0 (as measured from the Shuttle coordinate system where Y=0.00 and Z=0.00).** | | |
| PARAGRAPHS, FIGURES, TABLES AFFECTED (For PIRN use only) | | |

| Page | Paragraph(s) | Figure(s) | Table(s) |
|---|---|---|---|
| | 3.1.4.4 | | |

AFFECTED INTERFACING PARTIES

| SIGNATURE & ORGANIZATION | DATE | SIGNATURE & ORGANIZATION | DATE | SIGNATURE & ORGANIZATION | DATE |
|---|---|---|---|---|---|
| (A) | | | | | |
| (B) | | | | | |
| (C) | | | | | |
| (D) | | | | | |
| (E) | | | | | |

**EXCEPTION REQUEST**

**FROM:**

*Identify the requirement not being complied with.*

3.1.3.1.7.1.2 PAS/ULCAS ON–ORBIT OPERATIONAL ENVELOPE

APs and equipment shall be designed such that the payload does not exceed the allowable on–orbit operational envelope in accordance with Figure 3.1.3.1.7.1.2–1.

**TO:**

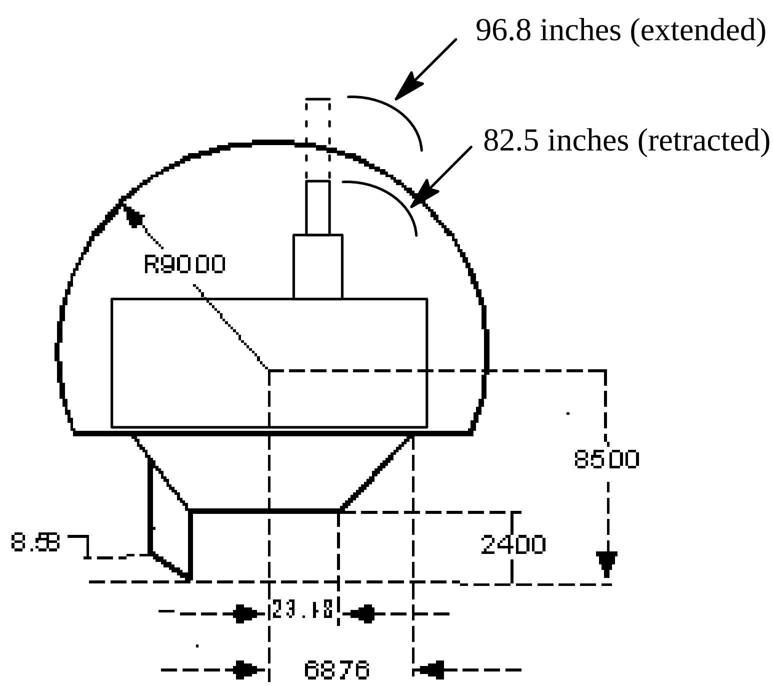
*State specifically what the non–compliance is.*

The design of the attached payload QUASAR requires a protrusion which extends 6.8 inches outside of the allowable envelope per IRD paragraph 3.1.3.7.1.2.

**DESCRIPTION OF EXCEPTION**

*Provide detailed description of the non–compliance and enough supporting rationale for approval to support an analysis of it's acceptability.*

QUASAR should be allowed to extend to its operational limit of R96.8 inches from the centerline of the payload (Shuttle coordinates Y=0.00, Z=0.00). See Figure below.




The extendable antenna onboard QUASAR extends and retracts a total of 14.3 inches such that when retracted the allowable envelope is not violated.

The antenna is required to be extended on an average of eight hours per day during payload operations.

The antenna can be retracted when necessary to ensure that mechanical interference between QUASAR and translating hardwares does not occur.

## PEI Analysis Results

*This will be supplied by PEI, it will document the analysis performed by the PEI Discipline representative to determine the acceptability of the non–compliance.*

## PEI Recommendation

*This will be supplied by PEI, it will document the recommendation of PEI based upon the analysis results.*

## PTR Disposition

*This will be supplied by the PTR and will document whether the PTR recommends approval or disapproval of the Exception Request.*

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# APPENDIX A
# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| α | Alpha |
| AC | Alternating Current |
| A/amps | Amperes |
| APPI | Attached Payload Port Interface |
| AWG | American Wire Gauge |
| | |
| BOL | Beginning of Life |
| | |
| C | Centigrade |
| C&DH | Command & Data Handling |
| CLA | Capture Latch Assembly |
| | |
| dc | Direct Current |
| DCB | Development Control Board |
| DLA | Drive Lock Assembly |
| | |
| ∊ | Epsilon |
| EBCS | External Berthing Camera System |
| EOL | End of Life |
| EPCE | Electrical Power Consuming Equipment |
| EPS | Electrical Power System |
| EVA | Extravehicular Activity |
| EVR | Extravehicular Robotics |
| EXPRESS | Expedite the Processing of Experiments to Space Station |
| | |
| F | Fahrenheit |
| | |
| HRDL | High Rate Data Link |
| Hz | Hertz |
| | |
| ICD | Interface Control Document |
| IMCA | Integrated Motor Control Assembly |
| IPC | Internal PIRN Coordination |
| IRD | Interface Requirements Document |
| ISS | International Space Station |

| | |
|---|---|
| ITA | Integrated Truss Assembly |
| ITS | Integrated Truss Segment |
| LRDL | Low Rate Data Link |
| MBS | Mobile Base System |
| MCAS | Mobile Base System Common Attach System |
| MIL-STD | Military Standard |
| MPICB | Multilateral Payload Interface Control Board |
| MRS | Mobile Remote Servicer |
| MSS | Mobile Servicing System |
| N/A | Not Applicable |
| NASA | National Aeronautics and Space Administration |
| NSTS | National Space Transportation System |
| ORU | Orbital Replacement Unit |
| PAS | Payload Attach System |
| PCB | Payload Control Board |
| PDGF | Power Data Grapple Fixture |
| PEI | Payload Engineering Integration |
| p/fm | pico farads per fixture |
| PIRN | Preliminary/Proposed Interface Revision Notice |
| POA | Payload ORU Accommodation |
| PTR | PIRN Technical Review |
| RPC | Remote Power Controller |
| RT | Remote Terminal |
| RTL | Ready to Latch |
| SDGF | Special Dexterous Grasp Fixture |
| SI | International System of Units |
| SPDM | Special Purpose Dexterous Manipulator |
| SRMS | Shuttle Remote Manipulator System |
| SSCN | Space Station Change Notice |
| SSRMS | Space Station Remote Manipulator System |

| | |
|---|---|
| SSP | Space Station/Shuttle Program |
| TBD | To be Determined |
| TBR | To be Resolved |
| UCC | Unpressuized Cargo Carriers |
| UCCAS | Unpressurized Cargo Carrier Attach System |
| ULC | Unpressurized Logistics Carrier |
| UMA | Umbilical Mechanism Assembly |
| VDC | Volts Direct Current |

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# APPENDIX B
# GLOSSARY OF TERMS

**Non–Normal:** Pertaining to performance of the Electrical Power System outside the nominal design due to ISS system equipment failure, fault clearing, or overload conditions.

**Operate:** Perform intended design functions given specified conditions.

**Safety–Critical:** Having the potential to be hazardous to the safety of hardware, software, and/or personnel.

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# APPENDIX C
# EXCEPTIONS

## C.1 PURPOSE AND SCOPE

The purpose of this appendix is to provide for a repository for PIRN forms prepared as a function of Exceptions to paragraphs of the IRD and/or the ICD Template as well as a listing of those paragraphs identified as Applicable With Notes. Each Payload Unique ICD will include an Appendix containing the data referenced above.

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# APPENDIX D
## OPEN ITEMS

### TABLE D–1 TO BE DETERMINED (TBD)

| TBD No. | Description | Document Section | Page No. | Responsible | Due Date |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

### TABLE D–2 TO BE RESOLVED (TBR)

| TBR No. | Description | Document Section | Responsible | Due Date | Resolution and Closure Date |
|---|---|---|---|---|---|
| 1 | OZ office to solicit Robotics Management Office and/or CSA approval and concurrence for MCAS and SSRMS interfaces with Attached Payloads. | Preface | M. Olson | 12/1/99 | |
| 2 | Available envelope for a payload keel trunnion is forward work. | 3.1.3.2 | G. Osorio/Boeing C. Bartunek/ Boeing | 11/1/99 | 2/5/02. Allowable envelope developed based on clearance analysis results and CAS Tiger Team review. Reference CAS analysis results in Boeing memo # 5–5165–MS–020152. |
| 3 | Further evaluation required to assess the ability to achieve a Class R bond at the fully seated guide pin/guide vane interfaces. | 3.2.2 and Figure 3.7.2.5–1 | V. Sanders / C. Young | 8/1/02 | 7/25/02. The CAS Interface Class R Bonding Test documentation test report MDC 02H1044 indicates that a Class R bond is achievable through the CAS interface based on the Guide Pin and interface design defined in SSP 57003 and SSP 57004. |

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